TRANSACTIONS

AND

YEAR BOOK

UNIVERSITY OF TORONTO
ENGINEERING SOCIETY

APRIL, 1931

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Electrical Building
The Mechanical Building
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Mill Building
Mining Building

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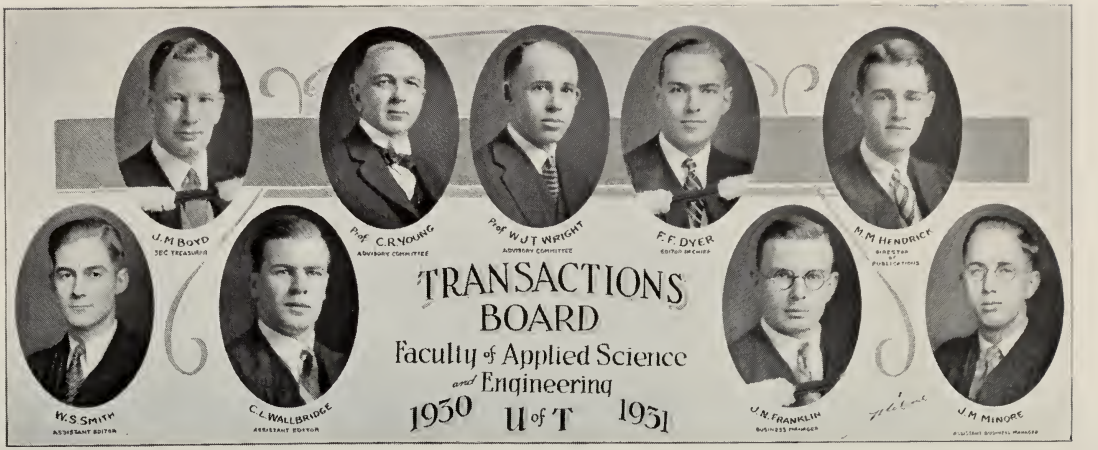
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TRANSACTIONS AND YEAR BOOK

OF THE

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

No. 44 APRIL, 1931

EDITORIAL

Once more this publication is submitted for your approval, or disapproval. This year seems to have been a very unfortunate one for editors of university publications, and it is, therefore, our hope that this year's issue of TRANSACTIONS meets with the approval of those in the seats of authority at least.

Although guided to a large extent by previous issues, the Board this year acted on a slightly different policy. In our opinion, at least, TRANSACTIONS should be, as far as possible, a record of Engineering Society and student activities. With this purpose in view, an attempt was made to secure a record of the Engineering Society meetings. This met with a certain amount of success, judged by the articles following. It is necessary to admit, however, that there was a partial failure, since there were two or three excellent meetings, of which it was found impractical or impossible to obtain an account. Another feature of this issue is the fact that there are extracts from three theses published. The original intention was to publish condensations of one thesis from each department, but here again it was found that this was impractical due to the fact that the theses required by some of the departments was of a nature not suitable for such publication. Our aim has been to make TRANSACTIONS as interesting to read as possible, and to appeal to all schoolmen, and it is our belief that the excellent articles contained in the following pages are well worth the attention of all.

May we take this opportunity of sincerely thanking the contributors, and all who have co-operated to make this issue what it is.

THE DEAN'S MESSAGE FOR 1931

To the Members of the Engineering Society

GENTLEMEN:

The past year has been an outstanding one, not only in academic work but in the activities of the Engineering Society. Those of you who have been here for several years can doubtless see that the excellence of the Engineering meetings has been marked. This success can readily be observed by the contents of this volume of the Society's TRANSACTIONS, for which the officers and members of the Society are to be congratulated.

The president and officers are to be complimented, too, not only upon the high quality and variety of the addresses before the Society but upon so successfully carrying out a number of activities and functions during the year.

I congratulate you who are graduating this year from the University. You of the junior years are equally fortunate for you will all be going out into life when the activities and prosperity of the country are again on the upswing. I ask you not to be deceived by what may appear, or what loose talk throughout the country may

represent to be, a period of depression. It is not so; it is just a temporary flattening of the upward curve of Canadian progress.

Our national progress is bound to continue and the engineering profession is bound to progress with it. Indeed, engineering is one very great factor in making for national progress, and well-trained engineers and better engineering will make it just that much better. The profession of engineering is most sensitive to financial and other conditions and, as these change, engineering activities promptly respond in sympathy. The momentum of the great engineering activity of two years ago can and will carry over the present quieter period. The much-discussed unemployment of the present time does not carry into the engineering profession beyond a comparatively small percentage, especially as so many of the great public works being prosecuted by governments and municipalities are increasingly calling upon engineers of various branches for help in carrying through their widespread programmes.

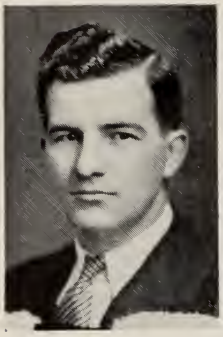
So, I repeat, not only to you who are leaving but to those of you who will be remaining, do not be anxious about the professional life you are approaching out in the world. You will all be "called" in due course and as times get gradually better you will all be "chosen" for better and more diversified occupation in the wide engineering fields for which you are now studying and preparing yourselves.

To be ready for this larger work and to be the surer of being "chosen" earlier, may I suggest to all of you in all years, diligently to improve yourselves not only by the curricula which are laid down for your study here in the Faculty courses, but by additional reading, study, observation and experience. The more extensive and diversified within your own spheres the better, for, during the next decade, Canada will need every engineer now going through our universities, and many times their present numbers.

With best wishes for your success and for your helpful service in this national progress.

C. H. Mitchell,

March 16, 1931. *Dean.*



PRESIDENT'S MESSAGE

Schoolmen:

It is in the order of things that our Varsity days finally come to an end; so it is with regret that I prepare my last presidential message to you. I regret also severing my official connection with the Engineering Society.

I have drawn up this address as a report of the Engineering Society's activities during the past year. Suggestions are inserted where they seem appropriate for the consideration of future Engineering Society Executives.

Due to the large registration, routine business such as running the store, collecting fees, the budget and setting things in order for the term, demanded almost all the time of the members of the executive during the first week. I want to thank them for their loyalty to the ideals, which we hope have been those of all Engineering Society Executives, for their loyalty to me as their President, and especially for their continuous hard work.

About the effects of our ever-increasing registration—quantity doesn't always mean quality; in fact, if care is not exercised, an increase in quantity may be at the sacrifice of quality. I believe it to be one of the unofficial duties of the members of the Engineering Society Executive to so conduct themselves that their examples will be a very powerful force in ensuring that all men graduating from S.P.S. will uphold the high standards expected from graduates of the old School. This thought I leave with you for the consideration of those who come after me.

Next, the first edition of "Toike Oike" called for action. The Executive reprimanded the Editor and appointed a Board of Censors. About five weeks later, the Faculty Council suspended the Editor for the balance of the academic year. The members of the Engineering Society Executive unanimously passed a resolution stating that they considered the decision of the Faculty Council unjust. The Joint Executive of the Students' Administrative Council, which is composed of the men and women student heads of all the Colleges and Faculties of the University, unanimously passed a similar resolution. The Engineering Society Executive petitioned the Faculty Council twice to reconsider their decision with a view to changing it. The Faculty Council refused to change

their decision. An appeal was made to the Senate by the Engineering Society Executive, but the Senate upheld the Faculty Council. We regret very much that the majority of a divided Faculty Council saw fit to do as they did against the practically unanimous opinion, not only of the students of School, but of the entire university. This case demanded an endless amount of work. I want to pay tribute to the untiring efforts of Ted Beament, John Franklin, Jim Boyd and Panay Ballachey.

The final result of this affair is most regrettable. There is a wide gulf between the Faculty and the students, a condition decidedly not in the best interests of anyone connected with School. We sincerely hope that those responsible will do everything in their power to narrow this gulf so that in the future, School will always present a united front. I hope to see the day when every Schoolman will be able to expand with pardonable pride at the mention of activities of any professor or student of S.P.S.

An effort was made by the Engineering Society to make a settlement with the Victoria residence men, whereby each would pay a share of the damages incurred in the Burwash-School skirmish. However, the Vic. men refused to entertain the idea of paying part of the "cost of entertainment," and the matter finally went to the Caput. They decreed that School should pay. However, the authorities at Victoria College fined the Burwash Hall men, thus acknowledging that their men were not without blame.

Our School Dinner was an affair of which we are very proud. There was a record student turnout—about 600. Dutton may well be proud of the way he handled both this function and the School At-Home.

There was such a demand for tickets for School Nite that Schoolmen had the unheard of experience of signing a list for them days ahead. The evening's entertainment was arranged and supervised by "Pop" Fotheringham. He did an excellent job.

The treasurer's report again shows a very healthy balance—thanks to the good work of Spence Jewett in running the store, and of Logie Donaldson in carefully watching expenditures. This year the treasurer is presenting the auditor's report up to March 31st, a month later than the usual treasurer's report shown in TRANSACTIONS. This is in keeping with an effort to run the Society on a more sound business-like programme.

This year we have put in finished form something of which I am very proud. I refer to the stencilled Machine Design notes now on sale at the Engineering Society store. The compiling of these notes by the Fourth Year Mechanicals in conjunction with Professor McIntosh is a long step towards the goal of having all lectures in printed form. In conceiving, editing and supervising the printing of these notes, Stan. Lawson has made a lasting contribution to the art of acquiring knowledge at School. I hope that during the next few years, notes on many more subjects will be put in such form. Why should Fourth Year Mechanicals be the only department to do such a work? I leave this idea with you and sincerely hope it bears much good fruit.

The Toike Oike staff has done remarkably well even under a handicap. The policy of the staff this year has been to turn out a few more numbers than usual. Our Director of Publications and Publicity, Max Hendrick, has also done good work in his other duties.

The Athletic Association, under Panay Ballachey's careful guidance, was unfortunate in not annexing the usual number of championships. We are hoping for better things next year.

The elections this year excited more than the usual amount of interest. The balloting and most of the fun was carefully arranged and carried out under Jim Boyd's watchful eye. He did an exceptionally good job.

Now we come to the "bugbear" of all presidents—general meetings. We have had some excellent speakers. All the meetings were well advertised around School; nevertheless at two of them the attendance was far from what it should have been. Schoolmen, I ask how can you justify yourselves in staying away from these meetings? How can you judge a speaker until you have heard him? The fact that your president has invited a man to address the Society indicates that he has satisfied himself that the speaker has a message that will benefit you. It is the special duty of the First and Second years to attend these meetings. I hope that next year this year's Freshman and Sophomore classes set a good example for next year's Freshman class by filling up C22 for every meeting.

I want to thank the Dean and the members of the Faculty for their help in securing speakers; for their counsel and assistance in some of the many difficulties faced by the President of the Engineering Society.

Since my first year, one of my ambitions has been to help secure better quarters for the Society and its members. But, up to Christmas of this term, our entire executive was so busy in the attempt to have the Director of Publications and Publicity reinstated, that we could not spare any time for this matter. If permission could be secured from the authorities, would not the south-west basement corner of the School building be an ideal location for the store, office, committee room and a smoking room? The executive-elect will have to start making arrangements this summer if they hope to have any results to show next year.

To your new president, Spence Jewett, and his executive, I extend congratulations and best wishes for success. Schoolmen, you have expressed your confidence in them at the polls, prove it next year by your whole-hearted support!

Thanking you for all that it means to have been your President,

Yours sincerely,

A. E. Tyson

1931

TRANSACTIONS

OF THE

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

FACULTY OF APPLIED SCIENCE
AND ENGINEERING

UNIVERSITY OF TORONTO

PUNCHES AND DIES

Condensed from a Thesis for the Degree of B.A.Sc., in Mechanical Engineering

BY B. W. HULFISH

Punches and dies are the devices that are mounted in punch presses to do work upon a material, and are used by practically all industries manufacturing a mechanical product. The nature of the work produced covers such a wide field, that punches and dies are manufactured to an unlimited variety of designs. They usually operate upon metal, but this is by no means always the case.

Generally speaking, the punch is that part which is mounted to the ram or moving member of the press; while the die is secured to the bolster which in turn is fastened to the frame of the press and remains stationary. It is common practice to refer to a punch and die, that work together, as merely a die.

Dies are generally classified into four groups by the nature of the operation they perform. These groups are: cutting dies, forming dies, drawing dies, and squeezing dies. The dies in the cutting group are further subdivided, as blanking, piercing, notching, shearing, trimming, shaving, broaching, dinking and compound dies; those in the forming group into bending, forming, curling and wiring dies; those in the drawing group into cupping, drawing, re-drawing, reverse drawing, reducing, bulging, and curling dies; while those in the squeezing group into sizing, swaging, rivetting, staking, stamping, embossing, coining and extruding dies.

Blanking and Piercing Dies

Perhaps the most common dies are the blanking and piercing type. The distinction is that the blanking die cuts out a desired piece, the remaining material being the scrap; while the piercing die cuts out a hole in the desired piece, and the material cut out is the scrap.

Drawing No. 1 shows what takes place during the working portion of the down stroke of the punch in dies of this type. In Fig. 1, a cross-section of the punch, die and material is shown. The section is taken along a diameter of the punch and die, which are circular, producing a circular blank and round hole. The edges *A* and *B* are sharp right angles of hardened and ground tool steel, and the material being cut is hot rolled steel. Figs. 1, 2 and 3 show progressive positions of the punch, and Fig. 4, the pressure in pounds at any position of the punch. Compressive stress is set up along *CD* and tensile along *EF*. The effect of the latter is to produce fractures starting at the corners, and in this case these meet, as the value of "*k*," the clearance, is correct. The work done, 4,300 in. lbs., is represented by the area under the curve. Figs. 5 and 6 show a cross-section and side view, respectively, of the completed cut. Pure shearing has taken place from *G* to *H*, but from *H* to *J*, the fracture is one of tension.

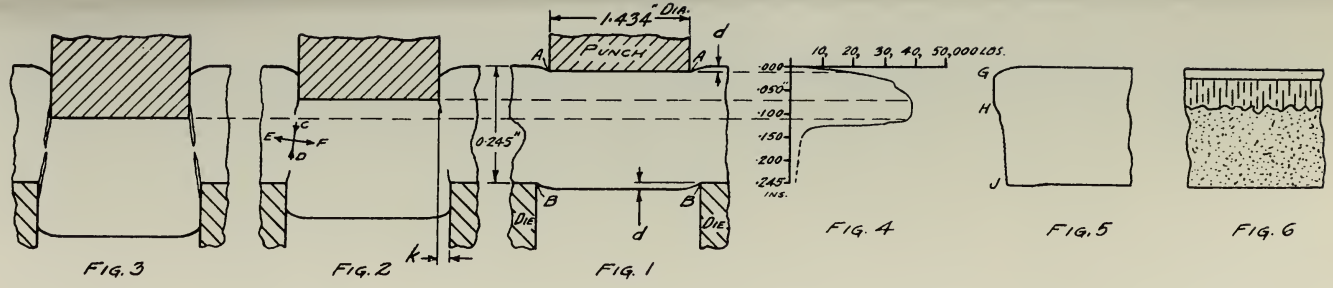


FIG. 3 FIG. 2 FIG. 1 FIG. 4 FIG. 5 FIG. 6

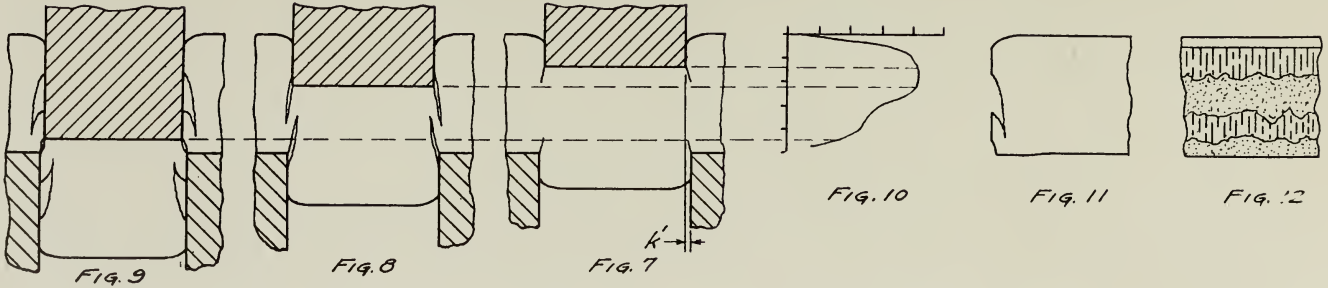


FIG. 9 FIG. 8 FIG. 7 FIG. 10 FIG. 11 FIG. 12

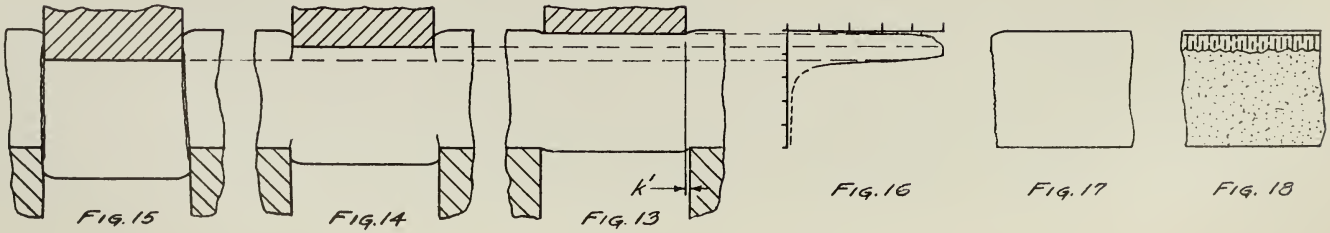


FIG. 15 FIG. 14 FIG. 13 FIG. 16 FIG. 17 FIG. 18

Figures 7 to 12 show the results of decreasing the clearance "k" to "k¹". The fractures do not meet and shearing must be done at two places in the stroke, which increases the work done to 7,500 in. lbs.

Figures 13 to 18 are for the same conditions as in 7 to 12, except that a harder steel is being cut. The fractures start sooner, and meet as in the first example. Hence this is the proper clearance for this material, and the work done is only 2,300 in. lbs.

The foregoing explains the importance of proper clearance upon the maximum pressure, work done and condition of the sheared edges. The sharp die edges eventually wear off and must be restored. This is accomplished by grinding a thin layer from the bottom face of the punch and top face of the die.

Shear is often employed on dies of the cutting type to reduce the maximum pressure. This shear consists of slanting the cutting edges of the punch or die and results in an action similar to that in a pair of scissors. The blank is then cut progressively around its perimeter, instead of being cut free all at once. Naturally the work is distributed over a greater punch travel and the maximum pressure thereby reduced. However, shear produces a side thrust upon the punch and die which is objectionable. This may be overcome by providing double shear, grinding the punch or die in two slanting planes so that opposite sides start to cut at the same time and produce two opposing thrusts which equalize each other. In applying shear, the product must be considered. When the blank is desired the shear must be put on the die, and will leave the scrap warped. In piercing dies the shear is put on the punch, leaving the surrounding material flat after the operation.

In general, punches smaller in diameter than the thickness of the metal are impractical due to weakness and lack of rigidity. They may sometimes be used when the clearance is made larger than normal, but should be avoided if at all possible. Where a large hole and some small ones are to be pierced with a single stroke, the punch for the large hole should be made longer than the small punches. Thus any pulling of the metal toward the large punch is completed before the small ones enter, and a possibly damaging side-bending force avoided on the small punches. In applying shear or stepping of punches as just described, the form of the pressure curves in Figs. 4, 10 and 16 should be considered, in order to obtain, as nearly as possible, a constant maximum pressure along the working stroke. When this is not considered, the pressure may rise to a maximum and then drop to almost zero, two or more times in the working stroke, resulting in severe vibration and shock not only in the die but all through the press.

Notching and Shearing Dies

These may be distinguished from other cutting dies by the fact that the punch does not cut all the way around its edge. The notching die cuts a notch in an existing edge of the material. The shearing die generally refers to one cutting off a piece along a straight edge.

Trimming, Shaving and Broaching Dies

Trimming and shaving dies are employed to produce a cut-edge free from tensile fracture as left by blanking dies, see Figs. 5 and 6. They operate upon a blank, located accurately above the die opening, so that when the punch descends a thin slice is removed from the edge all the way around.

The broaching die accomplishes the same function as just described except that the work is done upon a hole instead of an outside edge. The punch may be made with one or two shoulders or steps so that it takes two or three cuts on the down trip. Thus the punch resembles a broach.

Dinking Dies

These are used for cutting shapes from cloth, paper and similar materials. The punch is hollowed out to present a knife edge of the shape desired. The die may be a solid hardwood block. These dies, therefore, are not the same in their action as the dies just discussed, but are, nevertheless, cutting dies.

Compound Dies

Compound dies perform the operation of blanking and piercing at the same time. Fig. 19 shows the cross-section of a simple die of this type for producing the piece in Fig. 20. The outer ring "A," though part of the punch, is in reality a die, into which the punch "B," forming part of the so-called die, will enter. The piece "B" has two holes which act as dies receiving the punches "C." The punch stripper "PS" is of the spring type and pushes the pierced blank out of the punch on the up-stroke. The die stripper "DS" pushes the scrap off the die. The blanks from the two holes are pushed on down through the die shoe. Punches "C" are made shorter than "A" for reasons previously stated. The finished piece is released between the punch and die and removed by means of compressed air, or by inclining the whole press so that it slides off by gravity.

Bending or Forming Dies

There is no distinction between a bending die and a forming die. The function of either is to produce a permanent bend in the work. Due to the infinite variety of bending operations, formulae for the pressure required are of no general value. However, given a specific case, the maximum pressure required may be ascertained between wide limits, by using as a basis of calculation the fact that at the bend the material must be stressed greater than the yield point stress and not greater than the ultimate stress.

Shown in Fig. 21 is a bending die of the most simple and most frequently used type. It is that which produces a straight bend clear across the work, and in most cases the angle is 90°. When the material used has an appreciable spring the angle "A" must be

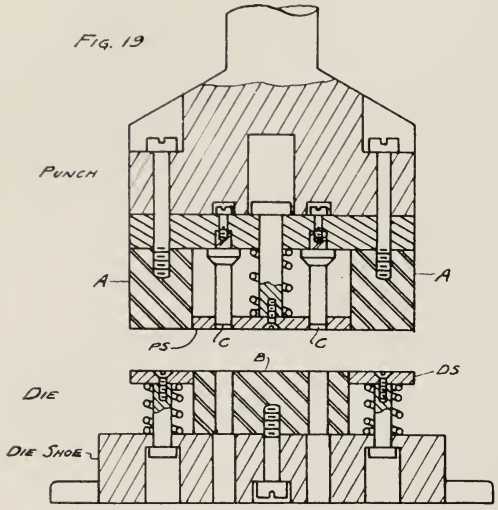


Fig. 19
Punch
A
A
PS
C
C
B
DS
Die
Die Shoe

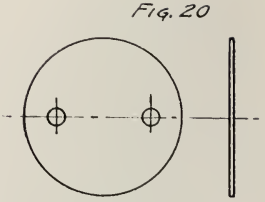


Fig. 20

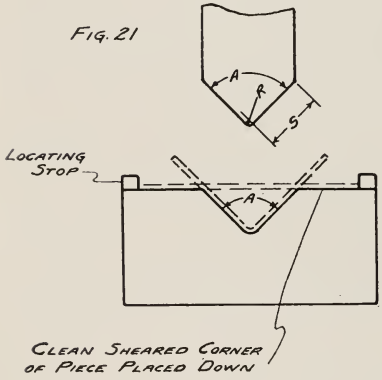


Fig. 21
A
R
S
Locating Stop
A
Clean Sheared Corner of Piece Placed Down

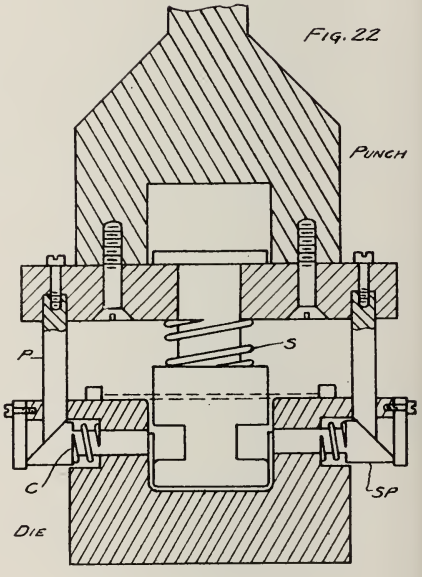


Fig. 22
Punch
P
S
C
SP
Die

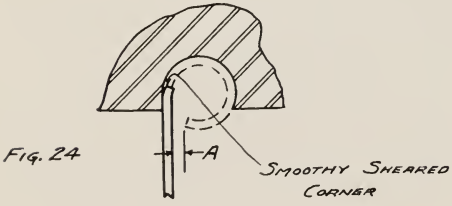


Fig. 24
A
Smoothy Sheared Corner

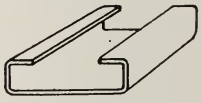


Fig. 23

made a corresponding amount less than that desired in the finished piece. The radius "R" should not be less than one-half the material thickness; preferably equal to it. "S," the length of the side, need be only about three times the radius "R." The punch and die are both tool steel unless the production is small, in which case they may be made of cast-iron. There is a fundamental difference in this type of die, as compared to the types previously discussed, in that this belongs to the "bottoming" class. That is, at the bottom of the stroke, the punch, work and die are pressed solidly together. Hence careful adjustment of the stroke at this point is absolutely necessary, or an extremely high pressure will be created, that may result in a break in the die or press. If two blanks are placed in the die accidentally, a break or severe strain is sure to occur.

Many forms of bending dies are designed. However, only a couple of types can be mentioned here. In Fig. 22, an example of the use of slides for side bending is shown. It produces the piece shown in Fig. 23, which ordinarily would require two strokes of a press.

Curling and Wiring Dies

These employ a cavity in the punch as shown in Fig. 24. The material enters presenting the sheared corner to the punch. Curling along a straight edge often gives trouble due to the waving of the work away from the side of the cavity. Therefore two operations are to be recommended. A clearance must be left at "A" to allow the finished work to be pulled out of the cavity.

Cupping and Drawing Dies

An example of the cupping die is shown in Fig. 25. It may be defined as die without a pressure pad, that produces a cup from a previously cut blank. An air vent is necessary in the punch to prevent a high vacuum between the cup and punch when former is being stripped off. The radius "R" should be from 6 to 10 times the thickness of the material, and come tangent to the vertical surface "A" of the die. Generally it is not tangent to the horizontal face, but this corner is slightly rounded.

Fig. 26 shows a drawing die for use in a single acting press. It differs from the cupping type in that it is provided with a spring pressure pad. This prevents the material from rising off the die as the punch descends, and also increases the stress in the material as it is drawn around the radius, a deeper draw being possible by this means.

Re-drawing and Reverse Drawing Dies

The next few figures show re-drawing dies. That in Fig. 27 is the simplest type, operating without a pressure pad. As before, the use of a pressure pad has its advantages, and this type appears in Fig. 28. This die is made for use in a double-acting press, where the pressure pad is operated by cams, and thus moves indepen-

Fig. 25

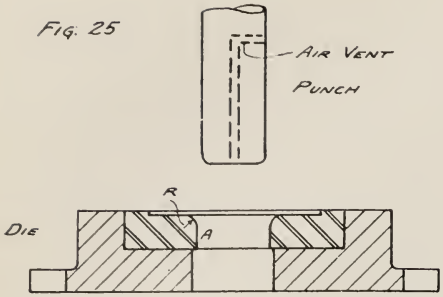


Fig. 26

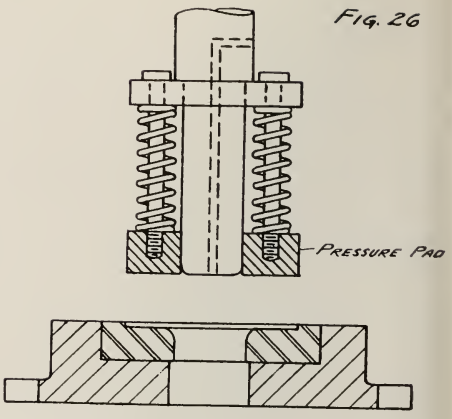
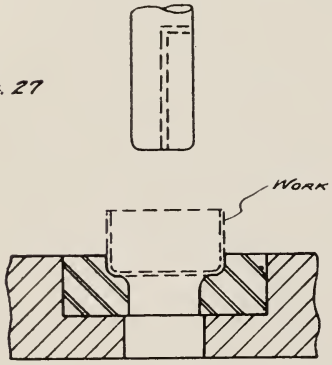


Fig. 27



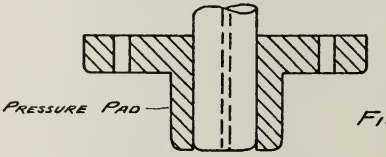


Fig. 28

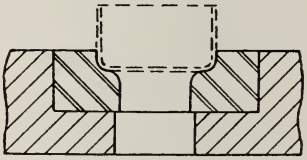
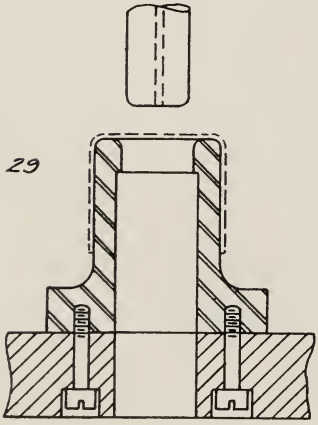


Fig. 29



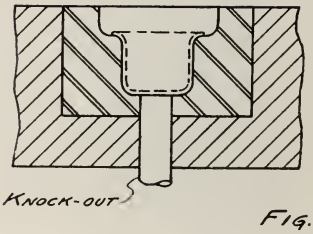


Fig. 30

dently of the punch. The cams provide an even pressure throughout the working stroke, which is an advantage over the constantly increasing pressure supplied by a spring pressure pad.

Fig. 30 shows a type of die used to produce a piece having a flange around the top. As the work cannot be pushed through, a knockout is provided, which is operated by the ram of the press, to return the finished part to the top of the die. The punch in this case would be as shown in Fig. 26 or 28.

In reverse re-drawing the work is placed in an inverted position, Fig. 29, and is turned inside out as the punch descends.

In the foregoing types of drawing dies, it is evident that tension is produced in the material in all directions radial to the punch, as the material is drawn along the horizontal face and over the drawing radius of the die. And compressive stress is produced at right angles to the tensile stress, or in circles concentric with the punch, until the material gets around the drawing radius. Both these stresses have a value greater than the yield point stress, or the material would not take a different shape; and less than the ultimate stress or fracture would occur. Hence the pressure of the punch can be calculated, for minimum and maximum values, by multiplying the minimum cross-sectional area of the material stressed in tension, by the yield point and ultimate stress, respectively. It can be concluded from this, that the greater the range between the yield point stress and the ultimate stress in a material, the more suitable it is for drawing operations.

When comparatively shallow and wide drawing operations are to be performed it is often necessary to employ one or more drawing beads or mouldings. This work must be done in a double-action press, and the bead consists of a long, narrow projection on the face of the pressure pad that comes in contact with the work, and a corresponding groove in the die. Then as the punch descends, the material is first drawn through the beading. This creates the desired high stress at the drawing radius proper. See Fig. 31.

Steel, brass and copper become harder as a drawing operation is performed, hence annealing is often necessary. But metals such as tin, zinc and lead suffer no hardening effects due to drawing.

Reducing, Bulging and Curling Dies

These are modified forms of the drawing die type. The reducing die is shown in Fig. 32; the punch in descending reduces the diameter of the open end of the shell or cup. Fig. 33 shows a form of the bulging die. The lower part of the punch is made of rubber, so that when it is pressed into the work the pressure is transmitted horizontally as well as vertically, and the material is bulged out into the groove in the die. The die is split to allow the finished piece to be removed. In the curling die the punch has a groove of the cross-section shown in Fig. 24. When this groove is circular, as required to curl the edge of a round cup, the material is sufficiently stiff to follow the curling surface of the die, and a good curl is produced without difficulty.

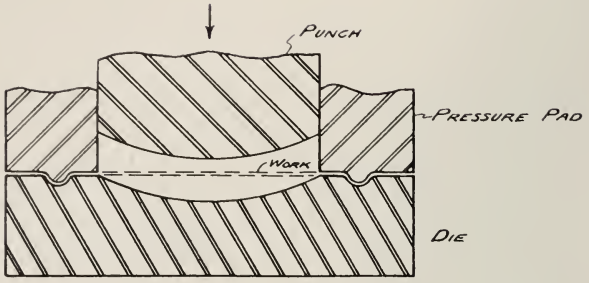


FIG. 31

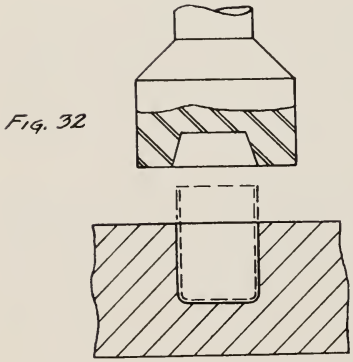


FIG. 32

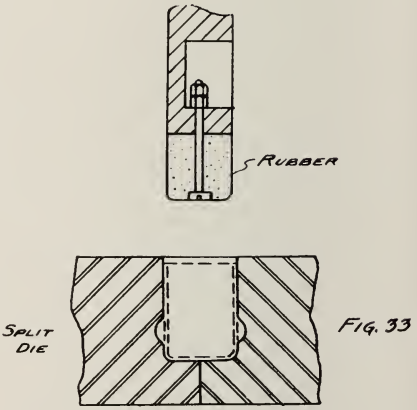


FIG. 33

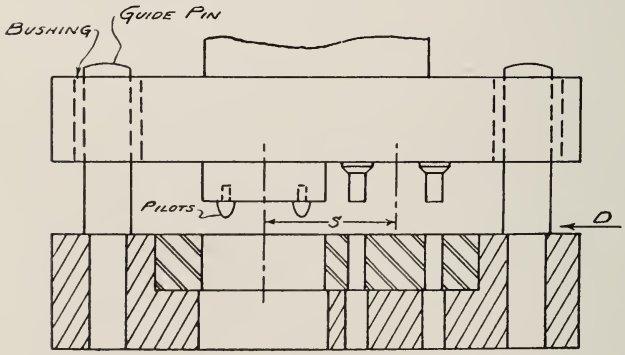


FIG. 34

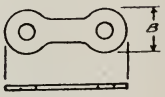


FIG. 35

Combination Dies

As the name implies, a die of this type combines two or three different operations in one stroke of a single, rather complex, punch. The work is carried downward as the different operations are performed. These operations comprise usually, a blanking, then a drawing or forming, and possibly a final piercing operation. The blanking punch acts also as a pressure pad for the drawing or forming operation. When piercing is required, the punches may be mounted in the bottom of the drawing die recess, and cut through into the corresponding die openings in the drawing punch. The piercing scrap is pushed on up through the punch and provision is made for its disposal. Such dies give extremely close accuracy between the different operations, but are expensive to manufacture and repair.

Follow Dies

These also perform more than one operation at each stroke of the press. But the work travels across the dies through stations, equally spaced; the work being done at each station simultaneously, which distinguishes them from the combination and compound types. In Fig. 34 an example appears, which produces work similar to a compound die. The product is shown in Fig. 35. Strip stock is fed in the direction "D." Two small holes are first pierced, and the strip moved on a distance "S." The next stroke blanks the piece and pierces two holes as before for the following piece. The work is located accurately on the blanking punch by two pilots which enter the previously pierced holes.

Guide Pins and Bushings

Two or more guide pins are often secured in a vertical position in the die shoe, the punch being fitted with bushings through which the pins slide. See Fig. 34. These are made to substantial dimensions to assure permanent alignment of the punch and die. They greatly simplify the mounting of the punch and die in the press, and contribute to long die life. And it has been found that these savings greatly exceed the cost of providing the pins and bushings where a die is scheduled for large production.

Squeezing Dies

The members of this group differ greatly from the three already described, in the function and pressures required. Sizing dies replace a milling operation and bring the thickness of a hub on a steel forging or casting down to the desired thickness, within limits of one-thousandth of an inch. The pressure required varies between 60 and 100 tons per sq. in., and knuckle point presses must be used.

Swaging or cold-forging dies work upon a previously blanked slug to produce an appreciably different shape. The material flows in practically all directions for short distances. The change in

shape is limited by the material worked and the strength of the die steel. Greater flow and more intricate shapes are produced when a hot slug is used, and the method is then known as press forging.

Riveting and staking dies are practically the same thing, the former applying only to dies working on round rivets. Their function is spreading the end of a rivet, thus fastening parts together. The unit pressure is high, but generally the spreading required is small so these tools are used in ordinary punch presses.

Stamping dies produce a design on one side of the work, while embossing dies produce the design on both sides. The embossing pressures are often of a higher order than those required in swaging.

Coining dies produce coins, medals, etc., having different designs on each side, and the strongest die steels are used to transmit the enormous pressure required.

Extruding dies force the material to flow through an orifice and the highest pressures occurring in squeezing dies are found here. Research work is now being done on these types and little practical information is available at present.

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MERCURY-ARC RECTIFIERS

Extracted from a Thesis for the Degree of B.A.Sc., in Electrical Engineering

BY M. WARD

A few years ago, the rotary converter or motor-generator was universally used for generating d.c. for traction purposes. Recently, the mercury-arc rectifier has been introduced into this field with complete success as its use has allowed the production of power to be split up into numerous small stations which can be located relative to the power demand centres. This is particularly effective in the case of traction lines having closely situated passenger stations.

The converting stations must be designed for the maximum power demand but must also have a high efficiency at light loads so as to obtain a high all-day efficiency. The mercury-arc rectifier meets all these conditions and was therefore decided to be used by the Berlin Rapid Transit Railway.

Almost every passenger station has been equipped with a rectifier sub-station, thus reducing transmission line costs. Also stray currents have been greatly diminished, and the interference between the d.c. lines and telephone lines practically eliminated.

As the mercury-arc rectifier does not require heavy foundations and occupies small space, the converting stations have been erected without extensive alterations.

The project of the railway company offered two schemes:—

(*a*) Concentrated distribution with rotary converter or rectifier sub-stations.

(*b*) Sectionalized distribution with rectifier sub-stations only.

After much study the choice fell to the latter, with small sub-stations at practically every passenger station.

Altogether, thirty-four sub-stations with a total of ninety-eight rectifier units having a total capacity of 117,600 kw., were required. The installation of the apparatus met with difficulties due to the fundamental requirement of keeping each of the principal constitutional parts of the equipment separated from each other, and in placing them in smoke and fireproof compartments. Each transformer room is ventilated by a small fan.

The equipment has been designed only with the strictly necessary devices so as to allow its installation in small space, and to work with the simplest form of distant control. Each rectifier is capable of supplying the load absorbed by a complete train, and each unit is rated at 1200 kw. continuous service at 80 volts. During rush hours, trains run at intervals of ninety seconds, giving a load cycle of 3000 amps,. during 40 seconds, and 300 amps., during 50 seconds; this unfavourable condition occurs when one rectifier unit fails and the two nearest units have to supply. Each rectifier works separately from the others and the contact rails of each track are fed independently.

The supervisory control covers closing and opening of the high-tension feeder oil-circuit breakers and disconnecting switches, and the closing and opening of the high speed d.c. circuit breakers and coupling switches. Every operation is signalled back to the controlling station as soon as it has completed itself.

The sub-stations are fed by three-phase, 30,000 volt, 50 cycle current supplied by two steam power-houses.

The decision of the company to use mercury-arc rectifiers is most important for the future development of this type of converting apparatus for electric traction.

High Voltage Mercury-Arc Rectifiers

With the development of radio, attention has been turned to the mercury-arc rectifier as a source of d.c. power. The first consideration is to have an air-tight glass container fitted with metal lead-in wires; a starting device is also necessary, and auxiliary anodes must be provided.

The most important cause of failure is due to short circuit between anodes and cathode, the common reason being the presence of foreign gases.

Short circuit is minimized by placing sharp bends in the anode arms and by protecting the anodes from falling drops of condensed mercury vapour. Deposits of evaporated iron on the walls also cause short circuits.

Cooling of Mercury-Arc Power Rectifiers

The rectifiers are cooled by water and there are three main methods of cooling.

(1) Direct cooling by continuous water supply: this being the cheapest and simplest, but because of corrosion, cannot be used for pressures above 2000 volts.

(2) Indirect cooling by continuous water supply: this being used if the water has a tendency to form scale due to hardness or impurity.

(3) Closed circuit cooling with a natural or forced draught: being used for pressures over 2000 volts. In this method the water system must be insulated from earth.

In the case of failure of the water supply, or an excessive temperature, each method operates an alarm device.

Rectifier Transformers

Transformers for mercury-arc rectifiers are used for phase transformation as well as for changing voltage. In order to obtain good regulation, the secondaries are interlaced and must be symmetrical with relation to the primary in order to avoid harmonics due to unsymmetrical leakage.

When an "arc-back" occurs, it imposes a short circuit on the secondary of the transformer, and the subsequent extinguishing

may cause a severe voltage surge within the transformer which the between turn insulation must be capable of withstanding.

These requirements of phase multiplication, close symmetrical interlacing and high insulation, are the chief reasons for the complexity of a rectifier transformer.

Hamilton's New Mercury-Arc Rectifier Sub-Station

The station is unattended and operates automatically or by remote control from another sub-station three miles away. The power enters at 13,200 volts, 3-phase and is changed to 495 volts, 6-phase in the rectifier transformer, from whence it passes to the rectifier and then at 600 volts d.c. to the station railway board.

The station will start and stop automatically, and the rectifier is protected against overload, overheating, or failure of the water supply. If tripped by an overload, the rectifier will reclose after each tripping for a pre-determined number of times, after which it is locked out; further, the d.c. feeder circuit breakers operate independently of the rectifier plant.

Mercury-Arc Power Rectifiers

Due to their advantages over rotary converters in efficiency, ease and reliability of operation, and ability to produce high d.c. voltages, steel-enclosed mercury-arc rectifiers are gradually replacing other converters in all fields of application. The high efficiency and reliability of mercury-arc rectifiers at high voltages will undoubtedly influence the selection of systems and voltages for main-line electrification. Owing to the fact that the d.c. voltage of a rectifier consists of portions of sine waves the voltage wave is somewhat undulated, the magnitude of the undulations depending on the number of phases, and varies with the load.

Portable Mercury-Arc Rectifier Sub-station

The entire equipment is mounted on a trailer car, and is completely enclosed, except for the transformer, in a corrugated steel housing. The station is supplied from 12,000 volt, 3-phase lines. In the switch-house are located a 12,000/220 volt, 3-phase transformer for supplying the auxiliary motors, and a motor operated oil circuit breaker.

The rectifier cylinder and complementary apparatus are at the other end of the car. The water-cooling system connections are made with rubber hose, and in winter the anode coolers are filled with anti-freeze. Filtering equipment is used to prevent telephone interference, and automatic shut-down occurs if the vacuum or water system fails, etc,

The over-all efficiency is 95% against the 80% efficiency of the motor-generator set it replaced.

The Voltage Drop Across a Mercury-Arc

The efficiency of a mercury-arc rectifier is determined by the

total drop across the arc. The drop varies, but in most practical cases increases with increase in current.

The voltage drop between anode and cathode is made up of three parts; that at the anode (about four volts) due to electrons accumulating in the vicinity of the anode surface and creating a space charge; that at the cathode (about nine volts) due to an accumulation of positive ions around the surface of the cathode; and the drop in the arc itself (about ten volts).

Since the voltage drop across the arc may be considered constant, the efficiency of the rectifier increases with increase in the voltage output of the unit.

Mercury-Arc Power Rectifiers for Wireless Transmission Plants

The difficulty of generating direct current at high voltages of 10,000 v. to 30,000 v., to supply amplifiers of transmission stations has been solved by the use of mercury-arc rectifiers.

They can be operated at any load, can withstand short circuits, can be set in service immediately, possess a high efficiency, have an easily smoothed output ripple, and can fulfil all the requirements placed upon them by wireless service.

For this reason, mercury-arc power rectifiers were installed at Chelmsford, England, in preference to motor-generator sets and thermionic rectifiers, and have given satisfactory operation since their installation in 1929.

New Trends in Mercury-Arc Rectifier Developments

Recent research investigations have resulted in notable improvements which have made it possible to build rectifiers of very large current capacities as well as for very high voltages, this being achieved by screening the anodes with concentric rings or wire meshes of iron or graphite..

Interference in commutation circuits due to ripples in the direct current delivered by the rectifier has now been eliminated, and backfires can be interrupted in less than eight cycles after their production by using both quick-acting d.c. breakers and high-speed a.c. breakers. The d.c. voltage is now regulated by controlling the electric field inside the rectifier.

Standard parts are now used for different rectifiers up to the largest capacities.

HIGHWAY CONSTRUCTION IN ONTARIO

Extracted from a Thesis for the Degree of B.A.Sc., in Civil Engineering

BY W. B. WEBSTER

The construction of Provincial highways varies greatly from province to province. Each locality within a province has its own traffic problems, and obstacles of various kinds to overcome. Ontario has characteristics of its own, but all have the task of constructing economic highways. Slow, heavy commercial traffic has, at the present time, practically given way to the more modern type reasonably light, fast-moving traffic. At the present time highways are being constructed for this lighter type with the exception of a few heavy-duty roads.

Ontario, especially in the north, has the problem of forcing the construction of roads of high grade over a short period of time. The rapid expansion of industry in Ontario makes it imperative to build roads that will handle the increase in traffic, and also keep the mileage of construction up to the rate of expansion. Along with these, the question of extreme weather conditions confronts the highway engineer.

Pioneer roads of the "through" type should be laid with an eye on the future. The location should be such that, with very little diversion and practically no changing of grade, a wide heavy traffic highway may be constructed on or near the same right-of-way. In many instances a highway is needed, and must be constructed, in a short period of time. As soon as it is graded and gravelled, it has traffic thrust upon it that warrants a pavement of the rigid or semi-rigid type. But, as the roadbed is new and has not had the proper time for consolidation, a pavement cannot be laid upon the grade. Lack of sufficient money may prevent the construction of a higher type of road. The cost of maintenance of this inadequate road becomes extremely high, but must be borne for a year or so.

Macadam design is based on the principle of utilizing the subgrade support at all points. The pavement thicknesses are varied to produce the maximum allowable pressure on the subgrade, and in this way utilize the full supporting value of the soil. Therefore, the flexible-base pavement moves in conjunction with, and stays in contact with, the underlying earth subgrade. Unequal settlement of the ground occurs in a great many cases, and the traffic action continues to transmit the wheel loads directly to the underlying subgrade. Due to the construction of the flexible pavement, the base conforms with the ground, and the surface becomes irregular. These irregularities have in the times of slow-moving traffic been of little importance, but with the present-day rapid speeds they become very disagreeable. The repairing of these irregularities in a macadam road is an easy, cheap and rapid procedure, and it does not destroy the effectiveness of the underlying pavement.

Changes in temperature do not affect a macadam road, and it does not have to be designed with this factor in view. In the case of rigid types, temperature changes must be taken into consideration in design, for changes in temperature produce internal stresses, resulting in contraction cracks and "blow-ups."

Frost heave materially reduces the distributing power of macadam pavements for a month or so in the spring of the year by breaking the tight internal lock; and it is at this time of the year that most macadam failures take place, as the subgrade is at its worst at the same time as the pavement has its least distributing power. In order to prevent failures entirely, it would be necessary to design needlessly thick for the remainder of the year. The cost of construction would be prohibitive, and it is found to be a better practice in a province like Ontario to design for favourable conditions, and depend on minor repairs for extreme conditions. The practice in Ontario is to restrict the commercial traffic of three (3) tons capacity and over, to one-half loads at the critical seasons of the year. This slight restriction reduces the cost of maintenance to a minimum and, therefore, makes the macadam a light and economical pavement for moderate traffic.

It has been found that a 12″ macadam bed will apparently give the same pressure on the soil as a 6″ base. It is considered that poor soil requires at least 12″ of macadam layer or its equivalent. The pressure distributed by a well-constructed gravel road will be about the same as with a macadam of equal thickness. It is difficult to derive a formula for the determination of the thickness of a macadam layer, since it depends on so many varying factors. A macadam road must not have much deflection under a moving wheel, for if the minute noticeable deflection occurs (churning) the pavement starts to disintegrate and falls into disrepair or goes to pieces completely.

From the construction of macadam and gravel pavements, it may be seen that they are the ideal type of road pavement for moderate vehicular traffic; that is, from 50 to 500 cars per day. These types of pavement by reason of their cost, are perferred to the rigid type, when constructing over a newly-made subgrade. When they become inadequate due to the expansion of traffic, they form an ideal subgrade for a bituminous or rigid type pavement.

Tar has not only the desirable quality of making a road dustproof, but it is a constituent of a road surface which has great durability and flexibility. It offers no more resistance to motor traffic than does an asphalt pavement. Tar has been proven in Ontario to be a cheap means of improving a macadam road. With a sturdy macadam or coarse gravel base, tar has been used as a binder and also as a wearing surface. This layer may be placed to a thickness of about one inch, including a mat of fine gravel or stone chips. If this is found to be inadequate another layer may be added. Tar has afforded to road maintenace an easy and economical method of repair. It may be easily carried with a main-

tenance crew, for patching along with some coarse and fine aggregate. This can be used for roads of either the flexible or rigid type.

Amiesite is a patented pavement of crushed stone coated with an asphaltic cement. It has been used on many miles of road with good results. It is shipped cold in a friable and granulated state; it is then spread on either a macadam or concrete base, and well rolled. Amiesite screenings are then spread and rolled, forming a surface. This construction costs about the same as asphaltic concrete per square yard. It resembles asphalt in appearance and has the advantages and disadvantages of all roads of this type. It is particularly adaptable to small jobs, such as the main streets of small towns on trunk roads, where it would not pay to set up an asphalt plant or where suitable asphalt materials are not locally available. The design of the base depends, of course, on the type used, whether macadam or concrete.

"Tarvia" is a patented product put out by the Barrett Company, Limited. There are many grades of this material for practically every type of bituminous pavement that is built to-day. Tar was first used on gravel roads with great success on roads of light traffic. The Mulch or Wisconsin method of treating a gravel has been, and still is, used to a great extent throughout the province. It was really the starting point of re-tread pavements. A plain gravel road is best maintained by ordinary blading and dragging operations.

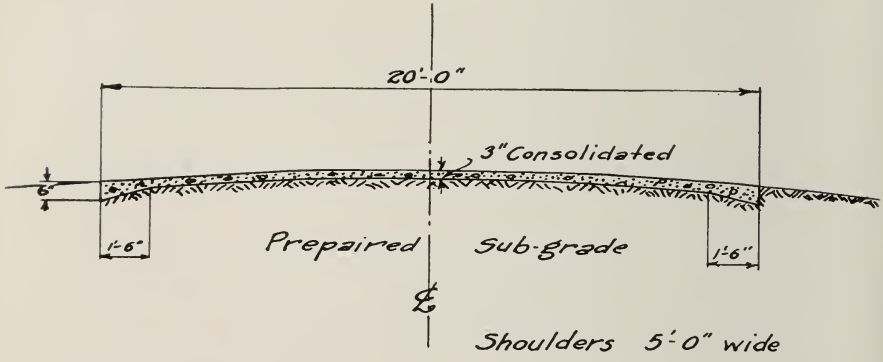
The plain gravel road usually passes from its satisfactory and economical phase of traffic service, when the number of vehicles accommodated is greater than 500 per day. From this point maintenance costs increase directly with the traffic. Investigations have shown that the annual maintenance cost per mile will be about one dollar for each vehicle which passes over the road on an average day. Thus if the traffic count per day is 1,500, the cost of maintenance of plain gravel per mile is very close to $1,500 per year (18′ road).

To abandon the gravel road at this point, and replace it with another type is an expensive operation, and many communities cannot afford to throw away investment in their roads and start over again. The plain gravel road fails because the top is ground away under traffic, provided it is not heavy truck traffic. This can be successfully and economically accomplished by using tar. It binds this surface material in place, eliminates the dust and also the loss of material, and the traffic value of the road is greatly increased. Highway officials throughout the province have demonstrated for a number of years that this can be successfully and economically accomplished.

Light tar has been proved to give the best results for this purpose. Light tar is a liquid at ordinary temperatures, but when combined with gravel will set up and form a double resilient crust. The tar penetrates into the surface of the road, and binds the particles of gravel firmly together so that they are not displaced by vehicle wheels. The dusty, loose, shifting gravel road is changed

into a solid smooth surface at only a small fraction of the cost of re-building the road. Blading or dragging operations are no longer necessary since the gravel is no longer loose, this constitutes a great saving in maintenance. There is no expense due to the loss of road materials as in the plain gravel road.

Tar-treated gravel roads will successfully carry several thousand passenger cars and light motor trucks per day. If the traffic becomes so heavy that the treated gravel road shows signs of disintegration, it can be used as a foundation for a penetration macadam top, thus utilizing all previous investments to the uppermost. Various methods of treatment have been worked out in different parts of the country. Variations in the process have been due to different characteristics of the gravel itself, to varying subgrade conditions, and to traffic demands. The methods may be divided into two general classes, a straight surface treatment, and the mulch or mixed in place method. The first gravel surface treatment work



BITUMINOUS RETREAD PAVEMENT
As used on
SEVERN-NORTH BAY TRUNK ROAD

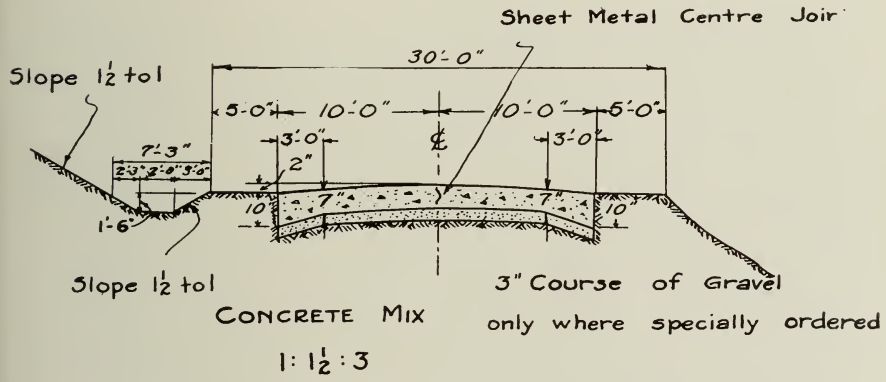
with tar was done using straight surface treatment methods, adapted from those used in treating water-bound macadam. The major portion of the tar surface-treated mileage is still handled in this way.

Many of the gravel roads throughout the province have been maintained with a loose mulch of gravel on the surface. In order to carry on the straight surface-treating operation, it is necessary to remove the loose material, thus losing a considerable quantity of good gravel. To conserve this material the turnover method of treatment was originated in 1923, and prefected in later years.

All these tar surface treatments should be maintained by patrol maintenance men for at least the first few weeks of their life. Gravel is not a uniform material and there will probably be some surface breaks. The road should not be allowed to fall into disrepair, since these roads are much easier and less costly to repair where the holes are small.

While the surface treatment of gravel roads with tar will greatly increase their traffic value, these are, after all, only maintenance operations. If, however, the highway is given the small amount of maintenance it requires when it is needed, the tar-treated gravel road will give wonderful returns for the money expended. The treatment of the surface is a great preventative for heavy rains, as it is a well-known fact that plain gravel roads cannot stand heavy rains.

The Wisconsin method of treating gravel roads was the first step in the direction of re-tread pavements. Re-tread pavements have been built in Ontario with great success to date. Taking all things into consideration they have withstood the test of the moderate traffic for which they were designed. This type of surface is not built for extra heavy commercial traffic, and due to its construction, under this type of traffic it would break up. It has been found,



CROSS-SECTION OF STANDARD CONCRETE PAVEMENT
as specified by
DEP'T. OF PUBLIC HIGHWAYS, ONTARIO

however (to date) quite capable of handling moderately light truck and passenger traffic as well as a concrete road. A really adequate test of this surface has not been completed in Ontario, since practically all roads built in this way are still handling traffic, and standing up well under the strain. It will take quite a few years yet to find out the real life of a pavement of this type.

Broken stone, slag and gravel have been used as the aggregate for re-tread pavements. Crushed stone is used in practically every case in this province. Slag or soft limestone absorbs a considerable quantity of the bituminous binder, and when using these aggregates it is necessary to increase the bituminous content (about 25%). The thickness of aggregate used varies somewhat, and usually runs from 3 inches loose to 3 inches consolidated. The thickness of the surface at the sides of the pavement is usually increased to 6 inches (as shown in sketch), to avoid "cracking off" of the surface. Aggre-

gate of size, 5/8 inches to 1 1/4 inches, is considered to be the most satisfactory. The use of small aggregate is to be avoided, since under heavy traffic it will tend to "churn," and the pavement will disintegrate rapidly.

The methods used in construction of all asphaltic concrete roads are fundamentally the same. The comparative ease with which they may be constructed and their low cost have rapidly brought them forward in highway construction over a short period of time. Due to their construction they can only be used for moderately heavy traffic, although they will withstand almost an indefinite amount of light traffic. For extremely heavy traffic the only answer to the solution at present seems to be the cement concrete type, the perfectly rigid slab construction.

The major portion of the highway system need not be of the rigid type. Cost of materials and construction prohibits its use unless necessary for heavy traffic.

The principle of the rigid pavement is to bridge over the weak parts of the subgrade, and carry the wheel loads to soils capable of withstanding them. In rigid as in all other types of pavements proper drainage is absolutely necessary, and if not properly taken care of will damage a pavement by causing heaving. The flexible pavement may be designed for average traffic, and if any failure takes place, it may be repaired economically or it may heal itself under the constant action of traffic. A concrete road must be built for the exceptionally heavy load since it is not so easily repaired nor is it self-healing. The heavy traffic that is thrown upon a concrete pavement greatly impedes maintenance crews; therefore concrete highways are built with the aim of cutting maintenance to a minimum, thus leaving the road open for traffic practically all of the time. It is practically the only type of pavement for congested traffic around industrial centres.

Concrete roads throughout the Province of Ontario have proved to be of a very high standard. The Toronto-Hamilton highway has withstood the test of extremely heavy commercial traffic for about fifteen years; no other type of pavement could have stood up under this strain. Asphalt-wearing surfaces are often used since they give an increased driving comfort to the traveller, but they have not the safety of the plain concrete in wet weather. A concrete road when subjected to heavy traffic may become "pitted" in time and must be re-surfaced. This is usually done with an asphalt or re-tread surface of some kind or other.

A fair comparison of the costs of construction and maintenance of various types of highways is very difficult if not impossible. Each is designed and constructed for its individual purpose, and in most cases no other type of road would be suitable. Obviously, it is as wrong to build lightly for heavy traffic, as it is to build heavily for light traffic. It is the aim of the province to get the greatest mileage per dollar that is possible. This is only possible if they build light and cheaper pavements for light traffic.

The mileage that necessitates light pavements is by far the greater, and more attention should be applied to it. If traffic is of the light type it is only natural that re-tread pavements are the types to use. If the traffic is of an exceedingly heavy type, this pavement could not be maintained at all, it would not hold together. It is an ideal type for growing traffic, for is the traffic increases a new layer may be added; for a reasonable bond with the underlying layer can be obtained. It is obviously not economical to carry this programme for very long for each layer practically doubles the initial cost of construction.

Concrete pavements are the last word in highway construction; their initial cost, although much greater than any other type, their life is longer and their maintenance cost is much less. They are the only pavements suitable for extremely heavy traffic, and considering the traffic they are subjected to, they stand up extremely well, and are a good investment in highly populated districts.

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The Barrett Company Limited.

CANADA AND THE CANADIAN PACIFIC RAILWAY

Condensed from the address given at the Annual School Dinner, Hart House, December 2, 1930

BY E. W. BEATTY, K.C.

It goes without saying that I am very glad to be your guest to-night. It is over thirty-two years since I graduated in Arts from University College, and I have only returned to it on three occasions in the last twenty-nine years. I admit, to my shame, that this is the first occasion on which I have been in Hart House, the beauties and usefulness of which I have heard extolled so frequently.

Your chairman was good enough to suggest that I might with propriety discuss with you for a few moments transportation history and conditions in Canada, with particular reference to the Canadian Pacific Railway. There is always a danger in asking a C.P.R. man to talk about the C.P.R., as his hearers are inclined to discount what he says on the ground that he talking about his own concern and may be prejudiced. He is placed, so to speak, in the position of an egotist, and an egotist is apt to become a bore unless he is unusually entertaining. In this connection I am reminded of an exchange of courtesies between two famous egotists as narrated the other day in his book of reminiscences by Forbes Robertson, the celebrated actor. These two egotists were Whistler, the artist, and Oscar Wilde, the playwright. A paragraph appeared in a London newspaper that "Whistler and Oscar Wilde were seen on the Brighton front, talking as usual, about themselves." Whistler sent the paragraph to Wilde with a note saying: "I wish these reporters would be more accurate. If you remember, we were talking about me." In answer to which Wilde sent a telegram: "It is true we were talking about you, but I was thinking about myself."

Many years ago when the United States was emerging from the distractions of the Civil War, Canada was a loosely-jointed series of separate British Crown colonies, between which came the wedge of the fur-trading territories of the Hudson's Bay Company. In order to unite them, it was essential that they should be linked by railway systems. At that time there was in existence two railways, both in Eastern Canada,—the Grand Trunk, financed by British capital; and the Intercolonial, built, owned and operated by the government.

Then in the late 70's came the ambitious project of a transcontinental line as a concomitant to a political federation of all these British colonies into one Dominion of Canada. British Columbia was insistent on this condition of a transcontinental railway before it would agree to enter Confederation, and as a result, the idea of

the Canadian Pacific Railway was born. Then and until 1881, it was a government enterprise. It has been offered to the promoters of the Grand Trunk but was refused as an impractical scheme. Undertaken, therefore, as a government enterprise, construction went ahead slowly, piecemeal and at an abnormal cost.

So great a political incubus did the project become that the leader of the government decided that the only chance of success was to turn the whole undertaking over to a private company.

If you will picture Canada at this period of its development, the same size then as it is now, equal in area to the United States, with a population of only 4,324,000 people and widely separated by long stretches of territory then unproductive and supposed to be incapable of production, you will have some appreciation of the colossal character of the undertaking. On the western extremity, five ranges of mountains had to be crossed, through passes which were both hazardous and in which construction was costly. Undismayed by the great difficulties and apparently undiscouraged by the prospect of inevitable failure which was cheerfully prophesied for them, this little syndicate, composed of Scotchmen, Canadians and Americans, undertook the financial obligation of constructing a transcontinental railway in ten years, and as an evidence of their faith, contracted to thereafter efficiently maintain, work and run the Canadian Pacific Railway for that short period of time known as in perpetuity. So well was their work done and so efficiently were they organized that they completed it within five years instead of the ten permitted them by the contract. In 1885 the provinces of Canada were joined by this thin rail of steel and the object of Confederation had been realized.

It is now over sixty years since the various provinces of Canada decided to unite in one common Confederation, and just forty-four years since the railway which made Confederation possible was completed. Even at that time the propriety of governments undertaking these projects as national undertakings and administering them by or on behalf of the government or whether they should be privately owned and administered was a debatable subject. The Canadian Pacific was offered and accepted what in those days appeared to be substantial assistance from the state, but which amounts appear very moderate when compared with those since granted or spent in aid of subsequent enterprises. Both methods were tried, and the construction by the government failed and the construction by private enterprise in this instance succeeded.

Then followed a series of ambitious projects, in each case adopted as part of the policy of the government of the day generously assisted by subsidies and guarantees, and in the end approved by the people, as evidenced by the support of the policies which brought them into existence. These undertakings, as we all now know, were conceived and executed long in advance of national or commercial necessity, and because there was not enough traffic to support them, they failed and were taken over by the government lest their collapse might result not only in their physical dissolution but also affect the credit of Canada and of Canadian institutions.

This action by the government was variously viewed throughout the country. Many accepted it as necessary under the circumstances. Others opposed it because they feared the consequences of the excursion of the government into business and on such a gigantic scale, and others unreservedly approved of it because they believed in the principle of government ownership and regarded it as a panacea for most of our transportation and economic ills. This difference of opinion as to the wisdom of government ownership is as old as the age-old controversy between those who believe in state socialism and those who do not, and the amalgamation of these systems under the aegis of the government has not changed the views of a great many of our most patriotic and experienced financiers and businessmen.

You will appreciate, therefore, gentlemen, that in the short space of twelve years the railway map of Canada has been considerably changed and we have now only two large systems, one governmentally owned and the other privately owned and operated. These conditions have brought new forms of competition in that it is carried on in a somewhat different atmosphere, and very keen and lively interest in railway questions on the part of the citizens of this country and of the business men in particular. It has also interjected to a greater extent political considerations as part of business administration. These factors do not affect, except in a general but not unexpected way, the activities of the private company, but they do naturally interest our men in public life and the taxpayers, the former of whom provide the necessary funds and the latter of whom pay the bills. The situation is unique, but there is nothing in it which cannot be readily understood and it involves no factors which were not anticipated. You will appreciate, because many of you have a very intimate interest in the affairs of the country, the difficulties involved in this form of competition. The problem of the national system, their prospects, their plans and their policies are all the subject of widespread publicity and propaganda. This is inevitable, and their officers are bound to live more on the platform and in the press than are the officials of a private corporation.

The Canadian Pacific is the largest taxpayer in Canada. It pays in federal taxes substantial amounts each year for the privilege of engaging in railway competition with the government of its own country. It does not inveigh against this situation but simply recognizes its existence and its inevitable consequences, and endeavours to the best of its ability to meet them. Perhaps I am old-fashioned, and I certainly am a prejudiced witness, but I have reached the conclusion that the things upon which the progress of this country has heretofore depended are those upon which our future prosperity will likewise depend. I believe that private initiative and the effort of corporations, groups of men and individuals are what will make for Canada's commercial prosperity and economic stability. I believe, with the late President Harding, that there should be less government in business, and more business in government. And so, when you turn your minds to this railway

problem, and it is a problem the last phase of which has probably not yet been reached, bear these circumstances in your minds: that public opinion is very often misinformed because the facts are not in the possession of those who advocate one theory or another; that where you have two houses and not enough guests to fill them both, there is bound to be some waste due to the duplication of facilities; that when companies with different sets of shareholders are in competition, the obligation of each is to preserve and expand their business, else they will die; that healthy competition is good, providing the minimum of waste is secured by economical administration.

In years gone by we had a slogan and the slogan was: What is good for Canada is good for the Canadian Pacific. Some enterprising journals who do not believe as keenly as I do in the merits of private ownership of railways, informed me in large type that I had got the thing somewhat distorted, and that what I really meant was: What is good for the Canadian Pacific is good for Canada. It really makes little difference in what order we place the Dominion or the railway; the fact is that the interests of the two are so definitely interlocked that both will progress if either progresses.

The company is the most national of all Canadian enterprises, conceived to bring about Confederation and executed and operated as a fundamental factor in Canadian development. When I speak in regard to it, I am, quite naturally and properly, considered a prejudiced witness, but a simple recital of what it is and what it does, will, I think, convince you of the high position it occupies in the scheme of things Canadian. You will appreciate that this company was first a railway company only and railway transportation is still its major activity. But the Canadian Pacific Railway Company of to-day is much greater than a railway company in the ordinary interpretation of that term. It comprises within one corporate existence many activities, several of which, taken by themselves, would be considered very substantial Canadian enterprises. It, for example, is a steamship company, and the largest Canadian steamship company. It is the only Canadian steamship company maintaining a first-class passenger service to and from Canadian ports, and its additions to its fleet in the last ten years have involved an expenditure of the sum of $95,000,000. It is a lake, river and coast steamship company. It is a telegraph company. It is an express company. It is a hotel company. Its hotel investment alone constitutes it one of the largest of its kind in the world. It is a land company. It is a settlement and colonization company. It is a lumber company. It is a mining company—the second largest mining company in Canada. It is a townsite and housing company. It is a coal company. It is an irrigation company and it owns and operates experimental farms. Some idea of the wide area over which the company's operations must of necessity be conducted is gained from the statement that in making out our monthly balance it is necessary for us to turn fifty-nine different currencies into dollar currency in order to give an accurate result

in Canadian money. We are, therefore, "two up" on the celebrated Mr. Heintz.

It is claimed in the United States that their transportation development has been so extensive that railroads are no longer just railroads, that their auxiliary enterprises, through the motor car and aeroplane, have turned them from railroad to transportation companies in the larger meaning of that term, and yet in Canada, our transportation companies do many things not usually incidental to the activities of American railways. We conduct our own express services, telegraph services, our sleeping car services, and, to a much greater extent than they, hotel services and auxiliary steamship services. In population we are where the American republic was one hundred years ago. In wealth our financial and industrial resources are moderate in comparison with those of the United States, and yet in transportation, we can, I think, fairly claim to be on a relative equality.

If it can be fairly said that in the United States railroads are not now merely railroads, it can be said much more emphatically that in Canada they have always been more than railroads. Canadian railroads as a whole have done great pioneer work in our country. Their contribution to development, whether agricultural, mineral or industrial, has been conspicuous, and their size, the number of their employees and the extent to which the country depends upon them, constitutes them, next to agriculture, the greatest single industry in the Dominion.

I represent a corporation which is peculiar in a great many ways. It is the only billion dollar corporation in Canada and one of only a few in the world. As I have indicated, its activities are many, varied and substantial. In fact, several of them taken by themselves would be regarded as notable Canadian enterprises. Notwithstanding the fact that the operations of the company extend to all parts of the world and we require to turn 59 different currencies into dollar currency every month in order to ascertain the results of our operations in Canadian money, ninety-seven per cent. of all our investments in railways and in subsidiary enterprises are in Canada, and from the date of its beginning the affairs of the company have been controlled by a board predominently Canadian and administered by officers almost exclusively so. These facts give it a peculiar national significance, and I am perhaps not divulging a confidence when I tell you that, from its inception, its policies have been dictated by faith in the country and an intelligent self-interest. I do not know of any combination of factors which tend more surely towards commercial supremacy than a combination of national sentiment, a sense of public duty and an unremitting striving for efficiency, in order that the solvency of the undertaking may never be questioned and that its owners may be adequately rewarded. In these factors the company I represent is at least outstanding. I have the pleasure of periodically speaking to our officers and, less frequently, to our men, and I like to stress the public nature of the company's operations and of its duty to keep faith with this country which gave it birth. There are many ways

in which a private enterprise can show its confidence in Canada, using the achievements of the last decade as an example. While it is not the largest railway company in Canada, it is claimed for it that it is the greatest transportation agency in the world and, I think, that claim is well founded. It is, in fact, a railway of substantial proportions, exceeded in mileage by only a few on the North American continent.

Canadian devlopment and the energy of this Canadian corporation has shown itself in other fields of transportation activities. At the conclusion of the war, the Canadian Pacific could not claim to have fleets which were in all respects modern. It was necessary, if we were to maintain our prestige, that these fleets should be improved by the addition of new ships of larger tonnage, of greater speed and superior accommodation. This policy was determined on and has never been departed from, with the result that the Canadian Pacific has to-day almost a complete new fleet, composed of tonnage built since the war and leaving only three vessels in service which were in operation at the outset of hostilities. In our Princesses, Duchesses and Empresses, we have set a newer and higher standard of steamship service in Canada and between Canadian ports and those elsewhere. We know that in addition to accommodation, speed and safety in travel, we must give our patrons service and food that meets the requirements of the most exacting and while one hundred per cent. efficiency is an almost unattainable objective in anything, we are satisfied we are making progress and determined that our efforts shall not be relaxed.

The additions to the company's fleets in the last ten years have involved an expenditure in excess of 95 million dollars.

May I mention another facility which is likely to come within the knowledge of you gentlemen, namely, the construction of modern hotels. In this we have made substantial progress. Practically all our principal hotels are of recent construction, the Chateau Frontenac, Banff Springs, Lake Louise, the Saskatchewan, Halifax, Digby, the Empress Hotel extension and the Royal York being all completed within the last few years. In the result, our total expenditure on hotels during this period is in excess of 42 million dollars. Again, well-constructed buildings and well-furnished rooms are not the only requisites, personal service of the highest order on the part of the management and of the employees of the hotel is also necessary—and with proper physical facilities provided, personal service is the test by which our efforts will be judged.

On the whole, then, that policy of a combination of faith in Canada, plus intelligent self-interest, has resulted in the past decade in capital expenditure by the company of an amount in excess of 386 million dollars.

A few years ago, if I had suggested to you that a railway company could also make a contribution, and a substantial one, to the cultural life of this country and to its solidarity as a nation, you would perhaps have smiled and said: "How is that a proper part of

transportation?" And yet it has been done, and through the agency of music, which is both national and international. Beginning at Quebec with French-Canadian folksong festivals, and proceeding westward to Winnipeg, Regina and Calgary with elaborate performances involving the songs and dances of our new Canadians, with a Scottish festival at Banff and sea music festivals at Vancouver and Victoria and old English music with folk-dancing at Toronto, the company endeavoured to emphasize the beauty of the national music of the people who inhabit this country, and it succeeded in reviving among them the pride of homeland and in stimulating loyalty to the land of their adoption. It was a simple and direct appeal to our newer and older settlers and citizens and made for harmony and understanding, because it was arranged by Canadians and was regarded as a tribute to the great races who share with the privileges and obligations of Canadian citizenship. The festivals, of course, had a widespread publicity value and were designed to assist the different services of the company from a traffic standpoint, but this practical motive did not militate against the real value of the festivals and the appeal to national sentiment and national pride involved in them.

I would like to stress a fact that is not always uppermost even in the minds of businessmen, of the importance of your railways to the prosperity and stability of business in Canada. They are making a contribution to day-to-day business, to development and colonization which, I think, is the greatest single factor in the country's progress. It may be depicted in many different ways but probably the simplest and most understandable is through reference to their figures. The daily payroll of the Canadian Pacific is $267,000. The daily disbursement for material and supplies is $220,000, and the daily tax bill is $21,900. Applying this same basis to the total expenditure of all railways in Canada last year, we find the total sum disbursed exceeded $500,000,000, or a little more than $50.00 for every man, woman and child in the country.

I am not a cheer leader and while I appreciate the cheer leader's peculiar methods and his possible usefulness, I do not ever expect to qualify as one. I can bear the disappointment, because a cheer leader does not play on the team. I am not a believer in the modern ballyhoo, nor am I a publicity expert; I doubt if I am a satisfactory propagandist, but I have a profound conviction that, among the thinking men of Canada due regard is given to facts, if they are accurate facts and not distorted figures, and I believe that a corporation will be judged by what it does and that that judgment will be a fair one, if the facts are known.

THE PORT OF LONDON

Condensed from an address before the Engineering Society on December 4, 1930

BY A. E. WILDEY

Public Relations Officer of the Port of London Authority

I have been deputed by the Port of London Authority to make better known the marketing and distributing facilities which the Port of London offers for produce from Canada and to ascertain from producers and shippers whether there be any way in which the Authority can help to facilitate trade between the two countries. There is no part of the British empire that has not at some time or other benefited by selling its products in London. To bring home this point I need only say that Britain is the largest purchasing country in the world and that the port of London deals with 40 per cent. of her import trade. This means that the London market spends approximately £500,000,000 per annum on overseas products.

London has been a market for over 2,000 years and its shipping and trade have progressed to the point where it is the greatest port and largest market in the world. Since the Port of London Authority took control of the port 21 years ago, its trade has gone ahead by leaps and bounds. For instance, in 1909, shipping entering and leaving the port totalled 38,510,000 net register tons. Last year this had increased to over 58,000,000 net register tons. This shipping figure is 20,000,000 net register tons more than the next most important port in the United Kingdom.

London's geographical position has facilitated its growth as a national and international market. The river Thames enables vessels of the largest class to enter the docks easily. Owing to its situation, 60 per cent. of the entrepôt trade of the United Kingdom passes through London.

London is the financial centre of the world and therefore exerts a tremendous influence on international trade. Bills of exchange on London are the currency of the world's commerce, and exporters and importers can make the most advantageous financial arrangements.

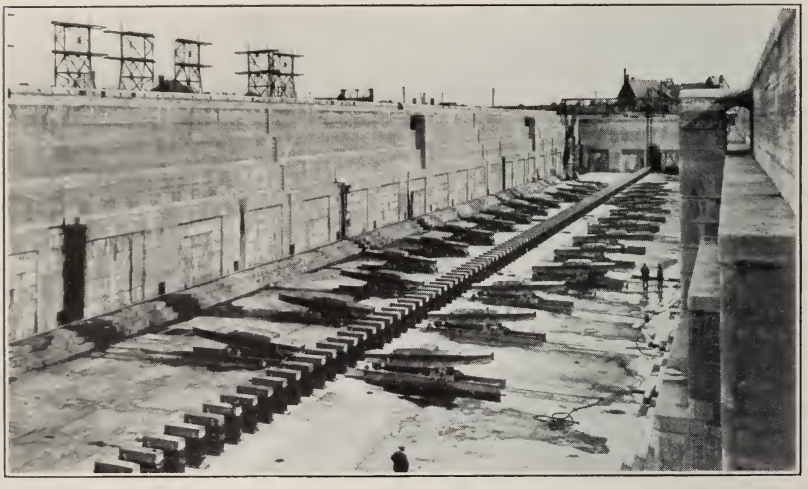
The London market attracts the largest number of buyers, both national and international. All goods that enter it can find buyers, and shippers who send their produce to London for realization are assured that it will be sold and, in the long run, at the best prices.

London has unequalled distributing facilities. There are 170 miles of railway lines in the Authority's docks, and merchandise can be loaded into or discharged from trucks alongside ship or warehouses, thus incurring the minimum handling.

The wholesale provision market of London is in Tooley Street and it is the greatest dairy produce market in the country. At the Surrey commercial docks, where large quantities of Canadian cheese

are handled, the produce is discharged and landed direct into cold stores. There are 7,000,000 cu. ft. of cold-storage accommodation available at the Surrey commercial docks and Tooley Street warehouses. Excellent sale facilities for fruit are available at Covent Garden, Spitalfields and elsewhere. These markets supply not only the needs of the local population but a large number of provincial centres as well.

London is the chief timber port of the United Kingdom and deals with about 33 per cent. of the total imported into the country. Last year about 2,139,000 tons of timber of all descriptions were dealt with. The Port Authority themselves have an expert staff for carrying out the requirements of the trade in the way of piling, stacking and marking.



NEW DRY DOCK, TILBURY DOCK

The increase in the export of paper on reels, chiefly newsprint from Canada and Newfoundland, has been very great during recent years and this business provides one of the most gratifying illustrations of the growth of Canadian trade with the United Kingdom.

In 1929, London imported 605,000 tons of meat, or 70 per cent. of the total for the country, and 1,100,000 bales of wool.

One of the most pungent reasons why Canada should look to London for increased sales is that London is becoming more and more a great centre of industry, bringing with it a natural corollary, an increasing population. This means greater opportunities for overseas traders to increase their sales there. It is an undisputed fact that there is a steady and certain gravitation of industry to the south of England due to cheap land, low rating, proximity to the Thames, the development of electricity and the accessibility to London.

The Port of London Authority was constituted in 1908 to take over the docks, which had hitherto been operated by private enter-

prise, and the tidal portion of the river from Teddington down to the sea, a distance of 69 miles.

The Authority consists of 28 members, 18 of whom are elected by the payers of charges and dues, the other ten being appointed by public bodies and government departments. The Port Authority is self-supporting. The revenue of the Authority is derived mainly from dues on ships and charges on goods, and after working expenses and the fixed rates of interest on the port stock have been paid, any surplus is available for the improvement of the port or for the reduction of port charges.

The functions of the Port of London Authority are many and varied. They own a dock estate of 3,442 acres, of which 723 acres are water, 45 miles of quays, with 1,650 cranes for the handling of a few hundredweight to 150 tons, and 10 dry docks.

THE PORT OF TILBURY

They are the largest warehouse-keepers in the world and are able to store over one million tons of goods, while accommodation for a further one million tons is provided by the public wharfingers in the port.

In modernising and extending the port, over twenty million pounds have been spent since 1909. The works upon which a large proportion of the capital has been expended are, it is submitted, beneficial to the Dominions.

The General Manager of the Authority, Mr. D. J. Owen, has stated that the story of London is the story of the British empire, and it will be obvious, therefore, that in the short time at my disposal, it has been impossible to speak of even all the main commodities coming into the port from all parts of the world, but I have endeavoured to refer particularly to those received from your Dominion. My object has been to bring before you the unrivalled facilities and favourable market condition provided by London.

THE FINANCIAL SITUATION IN CANADA

Excerpts from an address before the Engineering Society on November 4, 1930

BY A. E. AMES

Present-day Canadians are naturally optimistic and forward-looking, because—

1. Every setback in the past has been merely a pause in the march to greater accomplishment;

2. Canadians are not "a nation of shopkeepers," but a nation of producers, and our progress has been largely through the development of our natural resources;

3. During the lifetime of every mature Canadian the country has, with, of course, some fluctuations, shown a distinct upward trend.

Take the case of a man born in 1870, three years after Confederation: His most active business career would commence around 1896 and his business outlook would be coloured by the economic environment since that time.

Thirty-Four Years of Canada

It will, thus, be interesting to take a bird's eye view of the 34 years following 1896, just to realize the road upon which Canada has travelled in that, the most eventful, period of her history, with the hope that, perhaps, such a review may project some light upon the future.

This 34 years may be divided into six periods:

The 16 years—1896 to 1912—constituted an era of considerable expansion, in which occurred the opening of the Prairie Provinces and a widespread speculation in land, there and in many points of Canada. Though this period included some stagnant areas, and although, also, there were money panics in the United States in 1903 and 1907, with serious Canadian effect, and with shortage in currency and the use of clearing house certificates in the United States, the period was, upon the whole, one of Canadian expansion. It is interesting to note that the commencement of this 16-year period, *viz.*: 1896 and 1897, marked the culmination of a long period of liquidation in commodities throughout the world. Prices of commodities had reached the bottom, and, upon the other hand, but naturally, the prices of bonds had reached the highest. For instance, British Consols went to 114 in 1897, although their face rate at that time was only 2¾ per cent. In a few years this was to come down to 2½ per cent. The Canadian Government in 1897 borrowed in Great Britain on a security running for 50 years at the remarkably low cost of 2.81 per cent. Canadian provinces and municipalities were able to borrow at a little over 3 per cent.

Period of Pause

The second period, a short one, 1912 to 1915, was one of pause, and, in the latter part, readjustment to war conditions. As regards business in Canada, the first effect of the war was stunning. Business was as near a standstill as practicable, and minimum prices for securities were established on the stock exchanges, and while the situation was faced bravely, that facing was done in a spirit of depression. Incidentally it may be mentioned that in 1914 the Federal Reserve Bank system was introduced in the United States. Since that time it has developed from moderate into large proportions, and has been a great help in steadying monetary conditions in the United States, no actual money panic having occurred since the Federal Reserve Board commenced operations.

The third distinct period may be regarded as that of 1915-1920, a period of prosperity based on war orders for munitions, foodstuffs, clothing and other supplies, speculation in commodities generally, and speeding up of industry for mass production, with high prices for wheat and other grains. This was a feverish period. I know that the directors and management of a number of industries which finally got into the making of war munitions on a large scale and at fair profits had a great deal of anxiety in the earlier stages, with fear of loss and of discredit. Fortunately, their intelligence and perseverance, coupled with a liberal use of their own capital and of credits advanced by the banks, showed that the best of our Canadian manufacturers could compete successfully with the best manufacturers in other countries. Some of the manufacturers in Canada were not successful in this regard and had a very trying time.

Financing Was Effort

In this period during the war Canada surprised herself and other countries by the extent to which she was able to finance her own requirements. Of the $2,445,091,200 of war loan borrowings by Canada, $2,225,091,200 was supplied by this country and only about $220,000,000 by the United States. Canada financed her own troops during the war and in the end had a large credit with the government of Great Britain, through our having financed a portion of British purchases in Canada. Prior to this time only a very small proportion of Canadians held government or municipal bonds in their investments—perhaps 30,000 or 40,000. In 1918, however, when there was intense cultivation throughout Canada of the whole investment field following upon a similar intense cultivation in the previous year, there were secured loan subscriptions from 1,100,000 Canadians.

Serious Deflation Period

The fourth period is short—1920 to 1922. This was a time of deflation which was cruel in its operation. The year 1920 was the culmination of a period of rapid expansion. The war had ended two years before and a let-down following upon the war had been

expected shortly afterward. This let-down did not come when expected, and, against repeated prediction, the let-down was postponed so long that the mass of people came to think it was postponed indefinitely. So, we had a period during which there was a shortage in production as compared with demand, due to the time needed for adjustment of plants from war to peace requirements, and manufacturers were expending great effort to try to accumulate supplies. Raw materials were scarce; transportation facilities were deranged, and for this reason manufacturers often ordered much larger supplies at the very high prices then current that they needed.

Of course the end came. The orders were all filled, and the manufacturers found demand gone for the time and themselves stocked with heavy inventories at high prices. An official of one company, in describing this experience, said that at the last their supplies came in by the trainload and cancellations by the basketful. In the years 1921-1922, therefore, heavy writings-off had to be made so as to carry inventories consistently with prices then current. Some companies in Canada and many in the United States in their statements for the year 1921 showed heavy losses, running, in some cases, in the States, into many millions of dollars.

Great Expansion Period

The fifth period covers the years 1922-1929. Business had commenced a strong recovery after the depression of the previous two years and a new era set in in the pulp and paper industry, power and mineral development, highway and building construction and in foreign trade. The speculation in land which specially characterized the first four periods and the speculation in commodities which was at its height during the war were succeeded in these years by an extraordinary speculation in securities which spread wider and wider all over the continent. It had its most dramatic period a year ago, but that has been succeeded ever since by alternating spaces of hope and pessimism.

Become Lending Nation

During the last decade it is estimated that there has been an increase in national wealth of 35% and in national income of 40%, and that there has been a great advance in industry all along the line. Let us consider, also, the experience of the last decade in finance. The net national debt has been reduced by nearly 10%; we have supplied most of the money for Canadian development in Canada, though we have had access to all the foreign capital we needed; we have during the decade re-enforced the position of our banks, and the Canadian banking system is, as it has long been, a major factor in the prosperity of the country. For the years 1923 to 1928, Canada was among the list of creditor nations, having previously occupied the position of a debtor nation.

Another Pause in March

This brings us to the sixth period—the most interesting of all,

viz.: the present and the early future. As stated in the beginning, every set-back in the past has been merely a pause in the march to greater things. What will bring the next prosperity? The situation just now reveals a decline in production in domestic and foreign trade and in employment. Under the circumstances, this decline cannot be considered unreasonable and we may regard ourselves as comparatively well off. We are apt to forget how powerful are world conditions in determining our course in Canada, although we have such years as 1907, 1921 and 1929 and our present wheat condition to discipline us in this regard. We are too apt to look for rapid revival. The present situation with regard to finance is that credit is fairly plentiful, money rates are low for high grade obligations, but the market is not especially receptive to any but the very best securities. Speculative confidence is still reeling from the repeated blows that have been administered within the year. Our credit standing as a country is unimpaired and our provinces and municipalities also rank high with lenders.

Impatience for Revival

We now come back to the outlook and the question as to what will furnish the next impetus to prosperity. Hitherto our prosperity could be traced to a domestic situation based on expansion and development. Have pulp and paper industries, power and mining and agriculture been over-developed temporarily, and must we, in consequence, face the time of waiting, and how soon will confidence revive?

Well, impatience for revival—which is a characteristic Canadian trait—may bring on a recovery earlier than mere logic may at present suggest, because recovery is a thing to go and meet rather than to wait for. Anyone would be rash to predict just how and when prosperity will return in as strong degree as we have had it; but there are special developments which may be gone on with in an intelligent but forceful and prompt way, which, added to the normal reaction toward better business conditions, might find us at a comparatively early time in a condition of high prosperity. Some things that suggest themselves in this regard as well worth consideration and as influential in their scope are the construction of the St. Lawrence Waterway, with further development of power, and building up of those industries which thrive on low power costs, the opening of the area tributary to the southern portion of Hudson's Bay, with a northward push of settlers and explorers, a persistent drive for foreign trade, a new era of intra-empire commerce, development of additional branch factories in Canada by British and American concerns and advances through scientific discoveries and inventions.

No Narrow Boundaries

Having looked back for 60 years and taken a glance toward the future, we may for a moment look at the general condition of Canada in the same way that we would regard the position of any firm seeking credit. If one should be asked to purchase a block of

securities of any concern he would, if he had not already knowledge of it, inquire as to the extent of the field which it might reasonably desire to occupy, the character and extent of its assets, the record of its earnings and its earnings prospects, and the character of the management.

With regard to the extent of Canada's field of operation, it has no narrow limits. Our immense natural resources spread over wide territory, together with our scanty population, suggest room for employment and development which, proportionately to the population, is not equalled in any country in the world.

As to the record of earnings I have purposely avoided figures, but it is common knowledge that our natural resources have responded to the industry of the people in such a way as to furnish them with a good living, on the average, over a long term of years, and to permit the accumulation out of earnings of such an important amount of capital that, while our banks have a big total of deposits, our people have in addition an immense total of investments in land and buildings, in domestic and foreign securities and in projects looking to the administration of business already in being and to the development of resources which have not yet been exploited.

It seems reasonable to expect that a little later in the future Canada will be continuously a credit nation; that is, with more money available than is needed for the orderly development of this country. Outside reserves for a country are like buttresses for a building. They add strength.

Canada's Management

There remains to be considered the character of the management, or organization. While there is some analogy between the management and operation of a company and that of a country, one must not stick too closely to that idea. If Canada is to make more than an ordinary success of her future it will be due, more even than to the extent of her natural resources, to the ability, sincerity and ambition of her people. In that regard it seems as if we may be hopeful. A great part of our people are derived from what we are apt to consider the best racial stocks. If immigration is both sought and safeguarded so that it will join us in such proportions that immigrants may be assimilated into our population rather than come in such numbers as to endanger our ideals, we can hope for a high order of citizenship, an intelligent employment of rational methods and an available leadership that would compare favourably with any other in the world.

ENGINEERING EXPERIENCES IN NICARAGUA

An address before the Engineering Society on January 9, 1931

BY GORDON WALDRON, K.C.

MR. PRESIDENT AND GENTLEMEN:

In the presence of so many young men, who prepare to master the materials and forces of nature, one cannot but reflect on the part which you will play in the years to come in increasing the wealth of the world and extending the habitat of civilized men. You will, I hope, find employment in your own country. But, I have no doubt that, as you gain experience and reputation, you will go to other fields and among these to the American tropics, east of the spine of this continent from Yucatan to Colon, and thence easterly by the Spanish Main to the mouth of the Orinoco, to an immense undeveloped country bordering the Caribbean sea. To those who enter it by its rivers, which are its only approach, it is a country of marshes and impenetrable jungle, where the temperature falls never below seventy and the annual rainfall is sometimes as much as three hundred inches. Behind this barrier, is a vast area of uplands and mountains of healthful climate and, as we should say, of illimitable resources of agriculture, lumbering and mining, into which North American adventure has been slowly forcing its way. This hinterland includes, in Central America, the high and dry countries of the Pacific coast, where man has been able to conquer vegetation and make himself a rude home. Farther east, in the South American hinterland, for reasons not effective in Mexico and Central America, settlement is sparse. It is mainly because of a greater rainfall and the lack of roads and bridges. Four to eight hundred miles from the Caribbean, a mountain divide bounds the vast unsettled valley of the Amazon.

To this great Caribbean and Atlantic slope, some of you, as I have suggested, will, in due time, be lured by the prospect of adventure and the hope of gain. You will go to examine and superintend mines, to remove river bars and to build docks, railways, roads and bridges. Adventurous men will follow you and you will, then, lay out cities with drainage and water and light and power. And you will build factories and invent and superintend processes of manufacture. Some will warn you not to pursue wealth, and others, who are not without wisdom, will tell you that to keep mankind going a little longer, you who know and are able, must, taking all spiritual risks, go out to expand the habitable world. The world is crowded. Within my time, wise men looked on North America as a haven of the poor of Europe which would never fail. Already, the United States with a population of a hundred and twenty-five millions and fearing a meagre rainfall, closes her gates. Similar influences are closing the gates of Canada.

So some of you, at least, may profit by reference to the notes of an extended experience of the American tropics. I went to Nicaragua in 1896. It was at that time feared that the supply of crude rubber gathered in the tropical forests was about to fail. The government of the United States had asked its consular agents in tropical countries to report on the cultivation of rubber and a bulky blue book of replies was published about 1892. This book aroused the interest of a group of friends and I was sent to Nicaragua in December, 1896, with a thousand dollars in gold strapped to my person, to make a report on the cultivation of rubber. My experience has left me with an abiding aversion to metallic gold and to government reports of all kinds and all origins. I reported accurately that rubber, that is, the *Castilloa elastica* of Central America, might be easily cultivated. But I failed, as a result of narrow experience, to note many things, knowledge of which was necessary to those who invested in the proposed enterprise. I did not note the lack of roads and the means of travel and transportation or the great cost of keeping down vegetation, when the forest had been felled or the lack of such aids to enterprise as sawmills, foundries, blacksmith shops, and wood and iron working tools. Nor did I appreciate the inefficiency of negro and Spanish labour, which had no sense of straight lines, which could not be trusted to apply a monkey wrench, and, when sent to dig a ditch, could not be made to understand that the water must be made to flow as the ditch extended. Nor did I note that although the insect and bacterial agencies, which were effective in a warm and moist climate to destroy hydro carbons, destroyed in a year almost all trace of a felled forest, and were almost equally effective to destroy wooden houses, bridges, railway ties and even the handles of spades and shovels. From all that resulted, later, unexpected capital and operating cost. I did not note of course, that presently the cultivation of a better rubber tree, the *Hevea braziliensis*, would be undertaken in Ceylon and the East Indian tropics under more favourable conditions, and would bring the prices of crude rubber so low that Central America could not compete. Mainly, I overlooked the menace of the tropical hurricane, which strikes the south-eastern United States in August and, as the summer goes on, may strike with devastating effect Nicaragua, in October. My report was, I now know, unwisely accepted. Capital was generously contributed and I made, at a total cost of about $86,000, the first and only considerable rubber plantation on this continent. In it, for the first time, the problems of cultivation, tapping and curing were worked out. There was great difficulty with coagulation, that is, the separation cheaply of the water and rubber, as in the process of curdling milk. Evaporation in an atmosphere charged with moisture was impossible. It was noted that the huleros of the Amazon valley effected coagulation by dipping a paddle in the latex and turning over the smoke of a slow fire. What was the principle? Baffled, I sought the aid of this university and brought here a sample of rubber milk or latex, an account of the Brazilian method of coagulation and the suggestion of a German chemist that

acetic acid might be an effective coagulant. Your professors suggested that as acetic acid was a product of the distillation of wood, I might perhaps parallel cheaply the practice of the huleros of the Amazon by using crude pyroligneous acid to be had from the charcoal burners. The recourse suggested proved quite successful. The bill was five hundred dollars, which I thought too high and refused impatiently to pay. In the end I produced good rubber and sold in 1906, thousands of pounds at $1.20 a pound. Since that time cultivation of *Hevea braziliensis* in the east has caught up with and passed an ever-expanding demand and crude rubber as good or better than that which I produced has lately been selling as low as eight cents a pound. In 1906, a hurricane struck and destroyed completely this beautiful plantation. Had that misfortune been escaped, the venture would, of course, have been ruined by a fall in prices, which the wisest persons did not anticipate.

If you were to go to New Orleans, and thence to Bluefields, a trip no farther than from here to Vancouver, you would see impressive efforts of engineers to master the forces of nature. You would see a stupendous effort to protect by dykes or levees the rich lands of the lower Mississippi against spring floods—an effort which accumulates the waters in the river channels of the Mississippi and its lower tributaries and forces the engineers to build ever higher and stronger levees. You would note the Eads jetties, deemed a great achievement fifty years ago, by which a channel is maintained for ocean ships of deep draft. You would cross the Gulf of Mexico, sailing southerly, passing Cape Antonio at the west end of Cuba, and you would come, at the end of a thousand miles, to Cape Gracias or Gracias a Dios at the north-east angle of Nicaragua. Here, Columbus landed for the first time on the continent of North America, in 1502. Were he to return to-day, he would note no change, but a few traders' cabins covered by corrugated iron, and, if he sought the reason, he would learn that capital and its engineers had not, in the intervening four hundred years, been interested to open the bar of the Wanks river and to make roads and bridges conducting to the rich plateau, a few miles away. Had capital taken its engineers to this scene they would have failed, before the age of portland cement, because stone is not available, bridges of wood collapse in a few months and soft steel is oxidized in a few years. Should your ship lie to at the Cape, you might see a young engineer and with him, perhaps, his young wife, brought aboard staggering and enfeebled by a short sojourn at the mines in the interior, the fat boiled out of them as they poled for days upstream against a rushing current and not afterwards restored by a diet of rice and beans.

Threading your way cautiously through coral reefs and keys you would reach, at the end of another hundred and eighty miles, the Bluff and see Bluefields four miles away on the far side of the lagoon spread on the slope of Aberdeen Hill. These names would at once suggest that, long ago, English adventurers had visited these shores

and had withdrawn, we should say, because the time of the engineers had not arrived.

The forest presses upon the city and there is not a mile of road about it. All traffic is in the creeks and rivers, the narrow vegas of which are cultivated. That the land has been recently elevated is proved by beds of cockle shells on the slope of a plateau sixty feet above the sea. On the underlying igneous rock, has been laid, at the coast, a deep stratum of white clay, which must have been laid down in deep water far from land. On that is a stratum of red clay with which is mingled rounded pebbles, which must have been laid down near the shore of a lake or sea. On this red clay, over a large area, has been laid a considerable stratum of dark soil of volcanic origin. Cukra hill, six hundred feet high, is the greatest elevation. It is an extinct volcano and near it are several low cones of volcanic eruption. Relics of human beings show that the country was occupied by man when these contortions and eruptions took place. In making a railway cutting, I exposed at the juncture of the red clay and the volcanic covering several feet below the surface, a fireplace with charred wood, ashes, and the stones on which primitive men did their cooking. That they were not destroyed, but returned and dwelt about the hill for a long time, is proved by the stone implements and potsherds to be picked up on every square yard of the hillside. Long since, they and their descendants have been driven to the sandy meadows and sandbars of the coast, where the vegetation is feeble. Men of the stone age could not with stone implements withstand the jungle under present conditions of heat, moisture and sunlight. Clearly, the climate must have greatly changed, perhaps as the glaciers of Canada and the United States receded. In a change of climate, at all events, is probably to be found the true explanation of the decline of what is called the Mayan civilization, the remains of which arouse now our wonder and curiosity.

I made the experiment of abandoning the vegas resulting from overflow along the rivers and took my enterprise to the uplands, where the soil proved to be very rich. In 1903, I acquired a large tract of forest land for the cultivation of bananas and undertook the construction of a railway. In that, I nearly failed. I had gathered from Cape Gracias to Colon, three hundred and fifty men and housed them in a small clearing on the bank of a rushing creek. In July, at the height of the rainy season, they went down with malaria, and I could not put more than fifty men a day in the field. At a moment when I seemed to face ruin, I picked up by chance a copy of a New York newspaper giving at length the result of the investigation of Ross and Gorgas as to the function of mosquitos in malaria and yellow fever. I put this knowledge hastily acquired in practice at once. I made a large clearing, exposed the earth to the sun, kept the water moving, collected from day to day bottles, sardine tins, pails, barrels and everything, including plants, in which water might stand. In two months, my men were well, although millions of slow-moving anopheles sang in the swamp a quarter of a mile away. One may now safely enter the tropics with

a knowledge of the life of the mosquito and he may live in the tropics safely, if he does not pitch his tent at night in the native villages where the mosquitos are infected. It is a great achievement of science which has enabled the building of the Panama canal and will presently enable an enormous extension of the habitable area of the world.

Persuaded of the profit of lumbering, I erected a sawmill, the first on the Atlantic coast of Nicaragua, and took out a logging machine, by which as the railway extended I hauled to the railway the valuable timber. The result was disappointing. Promising woods sawn into lumber and piled became so decayed in three or four weeks that the boards might be easily broken. Two or three varieties only were worth sawing and the loss in working these was great because of the number of windshaken boards. Nor was it possible to saw boards longer than ten or twelve feet, because of the tension of the sapwood, which drew the log out of line, when a slab was taken off one side.

Vegetation is the chief marvel of the tropics. In it, the animals shrink and crawl and cower. Were it not for bacteria and boring insects, the land would be piled high with hydro carbons and we should be in a new carboniferous age of the world. But everything that has had a plant life is incredibly consumed. There is no humus on the ground. The farmer fells the forest but does not log it. He plants before he fells and in a year nearly every trace of the forest disappears. But he must struggle manfully to save his plants from a rivalry of vines, grasses and sharp plants, which shoot up like an arrow to spread their foliage and exclude the sun, and of broad-leafed plants which near the ground spread a deadly shade over their humble rivals. The cow thrives and pastures may be easily made. Indeed, in the struggle of man with vegetation, the cow may be his salvation.

The banana enterprise was very successful for a time. When it made display, the socialistic natives complained that a foreigner was exploiting the riches of their country and they would ask, "What part has the Supreme Government in this?" In due course the Gobierno Supremo imposed an export duty. Then, in consideration of a loan and a gift, a rival bought the sole right to navigate the river which was the base of my enterprise, caused my steamboats to be tied up and reduced me to travel by the primitive dugout and paddle. I promoted a lawsuit of natives objecting the unconstitutionality of the monopoly, until the president decreed that the lawsuit must stop. Having no hope of relief in the law, I got control of a newspaper printed by a graduate of the Brantford Expositor, and appealed effectively to public opinion. On the 19th of October, 1908, a hurricane struck a second time, doing great damage. At the same moment a banana disease appeared, and, sweeping forward in the direction of the wind, did in a few months millions of damage. Further effort of capital was not reasonably to be expected, and an enterprise which might have made a fortune for its promoters and elevated mankind in that quarter, was sold for about the amount of the original investment. I had recourse,

in a reckless mood, to my pen. I wrote in my paper of my disappointment, of the capital spent, of the failure of more than ten years' labour, and, then, I recited accurately the wrongs and follies of the government and its agents. This led to a riña or street row, in which the governor shot at me. On this revolver shot turned a good deal of history. The governor was dismissed, on the demand, I think, of a British minister, and a new governor was appointed who plotted a revolution. The president Zelaya was driven from power; Estrada, the new governor, became president for a time, and was succeeded by Diaz. The United States, benevolently disposed to prevent chaos, sent in its marines, who have been the subject of political controversy ever since and are now withdrawn.

I paid our debts, sold my beautiful cattle, bade farewell to my black friends and returned to the routine and conventions of my own country. The tropical vegetation closed over the scene of my labours and the natives who had converted the wages of my employ into clothing, wedding veils, sewing machines, cane mills, and even books and support of missionaries and teachers, relapsed to the state of civilization in which I had found them. Civilization seems to be a product of capital. Presently capital under your guidance will make a permanent way to hidden wealth. Most important, it will make a way to the farm lands and pastures, if enduring progress is to be made. Men of imagination will build, one of these days, a railway from such a terminal as Lake Maracaibo to Manaos, which will pour the wealth of the Amazon valley into the commerce of the world.

Do not say that the picture which I have painted is not alluring. When your time comes, the American tropics will offer you more than it gave to me.

TORONTO WATERWORKS DEVELOPMENT

Taken from an address before the Engineering Society on January 26, 1931

BY WILLIAM GORE

There are some 700,000 people that Toronto supplies with water, of which about 600,000 are in the city itself. Toronto supplies water to Swansea and parts of York County. These people demand plenty of safe pure water, and it is the work of the waterworks department to supply them. This growing community has necessitated extensions from time to time, the duplicate system now being installed being the latest and by far the most important.

Supplying water to a territory ten miles from east to west, and to sections 375 feet above the level of the bay presents some difficulties. To accomplish this, three main pumping stations are located along the bay front and six "booster" stations are placed at points further north on the higher ground.

The new water intakes will be one and a quarter miles out into the lake. When completed the water intake will consist of three pipes, only one of which is being laid at the present time. The first three hundred feet of this pipe extend out into the lake through a tunnel under the floor of the bay so as to avoid the heavy disturbances which exist in the shallow water close to shore. By this means the danger of a pipe breaking or moving is much lessened. The intakes of the present pipes have been troubled with mud, requiring dredges at times to clear it away, but the new one will be far enough out to avoid this.

At present the water is drawn in at Toronto Island, pumped across to Hanlan's Point, by shaft to John Street and from there to southern Toronto and to other booster stations. Reservoirs are situated in different parts of the city to keep up the pressure at peak periods. The difference of level between the bottom of the intake pipe and the top of these pressure towers is about 600 feet.

In connection with the new system a large reservoir is being built at the corner of St. Clair and Spadina. This represents a very extensive unit and has presented many difficulties in its construction. It has a capacity of 50,000,000 gallons and is constructed of reinforced concrete. A cement mixer was installed in the middle of the reservoir area from which it was possible to run the cement to any part. The materials were brought to the job by T.T.C. cars and dumped into bins, from which they were transferred to the mixer by a belt as needed. All the latest ideas in regard to concrete were adopted, and weighing apparatus was installed for accurately measuring the quantities.

The main plant is at Victoria Park, just outside the city limits in the east. The intake is within the pumping station itself, the

water being conducted into settling basins in order to allow the coagulent to separate out of it. From these tanks it passes to the filters which will have an ultimate capacity of 200,000,000 gallons a day, the largest attempted in the British empire. This building when finished will be the biggest in Toronto, being about 800 feet from end to end. From the filters the water goes into the force-pumps or into the pure-water tunnel connecting this station with the Sunnyside pumping station.

This pure-water tunnel will be nine miles long, passing under the bay through the underlying shale. At two places it was necessary to dip the shaft to go beneath the beds of ancient rivers which had made deep cuts into this shale. The shaft at the eastern end is 55 feet deep and was driven down by the use of two lengths of steel cribbing.

The tunnel was blasted out by dynamite, eighteen to twenty-one charges being placed in three rings and set off at intervals of five seconds. The shale breaks away in a square shape, leaving smooth roof and floor, but jagged walls. The loosened rock is brought out by the use of mules and carts, which have been found to cause less trouble than electrical equipment. The ceiling and walls are reinforced with timbers and are further protected from weathering and crumbling by spraying cement from a pressure gun. Every precaution is taken to protect the men. Electric lights are used throughout, and ventilating tubes carry off all fumes. The tunnels when finished will be six feet and eight feet in diameter with a cement lining about one foot thick.

PHOTOGRAMMETRIC THREE-DIMENSIONAL AIR SURVEYING

By Brig.-General Sir Charles Delmé-Radcliffe
K.C.M.G., C.B., C.V.O.

The process which the British Cadastral and Topographical Air Survey Company Limited (B.C. and T.A.S.C., Ltd.), has been formed to operate throughout the British Empire, is the patented invention of Signor Umberto Nistri. It may be safely affirmed that his inventions are of the greatest technical value, and have resulted in no inconsiderable re-adjustment of the attitude of the surveyor to aerial methods.

Hitherto the surveyor has looked upon aerial methods as supplementary to his ground survey and only to be used for obtaining detail in districts which proved too difficult or too laborious to survey on the ground, or in those cases where accuracy was a second consideration.

The Nistri Method, however, from photographs taken in the air, produces maps, on any scale from 1:500 to 1:100,000, the accuracy of which is equal to that of the most careful survey executed entirely on the ground. The speed with which the work can be accomplished, together with the large reduction in the cost, must lead in time to its adoption for most survey purposes. It was appreciated by the inventor that, in order to be of real value, it is essential that the method should enable the ground to be accurately contoured at any desired Vertical Interval[1]; and, further, that the reproduction of the data obtained from the air photographs must not if it is to be economical, involve a large amount of subsequent mathematical calculation, with a corresponding increase in the overhead charges.

By the process which he has invented both these desirable ends have been achieved.

Surveys from the air have been made to an increasing extent during the last few years. But, usually, these have been nothing more than planimetric[2] compilations from photographic mosaics. When approximate contours have been inserted, this has been possible only at the cost of great expenditure both in time and in money. The Nistri Method is the only air-survey method in existence which allows, in a practical manner, of accurate contouring and surveying on a cadastral or any other scale.

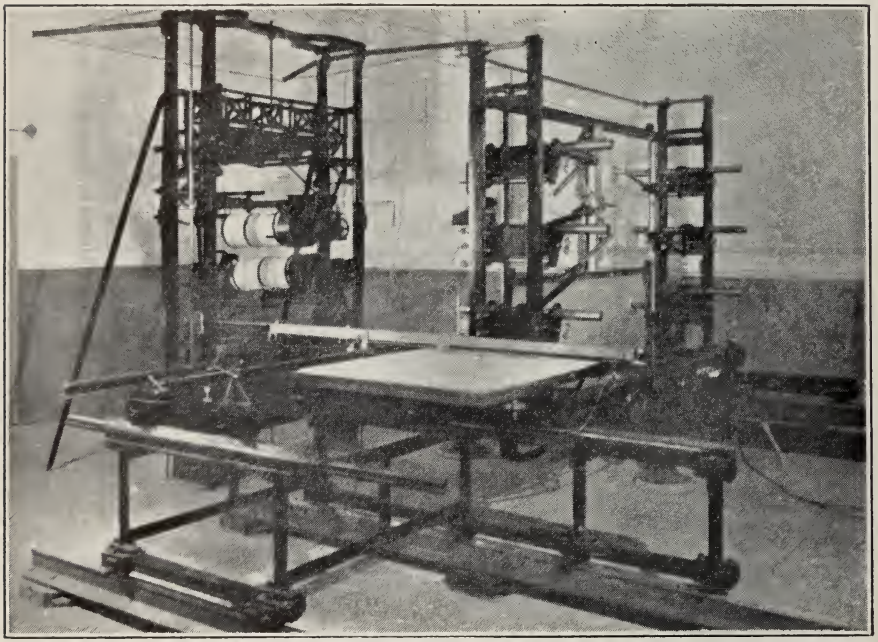
In principle, the process consists of taking from the aeroplane a number of photographs as the aeroplane moves over the area to be

[1]Contours are horizontal form lines following the outlines of the ground at fixed distances, called "Vertical Intervals," from each other.

[2]A planimetric survey is one giving only a horizontal representation of the ground without any indication of heights or of the shape or relief of the ground. In an altimetric survey the heights are indicated, referred to some "datum level" such as mean sea level.

surveyed. These photographs form series of overlapping pairs, taken at short intervals of time and so as to secure a 66% overlap longitudinally and laterally. If the area to be surveyed be small, the whole of it may be obtained on one pair of plates. If, however, a considerable area is to be dealt with, a constinuous series is formed by parallel flights giving the corresponding lateral overlap, until the whole area has been covered.

A triangulation or traverse[3] on the ground is necessary, in order to provide the skeleton, or "control," on which the photographs are adjusted and plotted.



NISTRI PHOTOGRAMMETRIC CARTOGRAPH

The photographic plates when developed are taken to the Mechanical Plotting Department, where they are inserted into a large instrument called the "Photogrammetric-cartograph." This machine, after the adjustment of the plates has been effected, is almost entirely mechanical in its operation and it constitutes the most important part of the process. The appearance and nature of this instrument can be seen in the illustration, which shows one erected in the offices of the parent company, in Rome. By means of this instrument the maps are produced directly from the pairs of

[3]A traverse is a connected series of straight lines of measured length and bearing.

negatives, on any required scale and with the contours drawn at the vertical intervals desired.

In order to test the accuracy of the method, some experiments were carried out under the inspection of the Italian Government in the Commune of Tivoli, which had recently been surveyed by the State Survey Department by the most approved ground methods. When the maps obtained by the two methods were superimposed such divergences as resulted were found, on re-examination, to be to the disadvantage of the ground survey. Similar tests have now been conducted elsewhere.

THE NEW MILL BUILDING

When the School of Practical Science was established in 1878, one of the original courses of instruction was Assaying and Mining Geology. Professor E. J. Chapman, then Professor of Geology, established the first laboratory in connection with the course. This was an assay laboratory located in the old S.P.S. building.

In 1888, Mining was added to the course in Civil Engineering which became Civil Engineering (including Mining). Four years later it was deemed advisable, because of rapid expansion, to establish a separate course in Mining Engineering. This necessitated the establishment of mining laboratories, which soon followed. The early equipment installed in this laboratory included a small Dodge crusher, a three-stamp battery, a fine vanner, a roasting furnace, and a small tank for cyaniding.

Still further developments proved the inadequacy of this limited equipment and the necessity of larger quarters and more extensive apparatus. To meet these requirements a building, 76 feet by 80 feet, one storey in height, was erected in 1904, which we have since known as the Mill Building. In keeping with this new structure, new installations consisted of a five-stamp battery, trommels and jigs, a Wilfley table, a Cornish buddle, a Hadfield gyratory crusher, a set of rolls, and other smaller apparatus.

This development took place under the direction of Professor G. R. Mickle, now mine assessor in the Provincial Department of Mines, and was an expression of clear vision and justified confidence in the future of the industry. At almost the same time, assaying laboratories and a small metallurgical laboratory were established by Professor Mickle in the basement of the building then known as the Chemistry and Mining Building. From time to time, additional apparatus was installed in both these laboratories until they became overcrowded and as a result could not be kept up-to-date.

In the spring of last year the Hon. Charles McCrea, Minister of Mines for the Province of Ontario, came to the rescue and the Provincial Department of Mines presented $232,000 to the University of Toronto to erect and equip a new building. This building is an enlargement of the old Mill Building, extending it 26 feet to

the north and four stories high, with a basement under the new extension. The building is of steel construction with concrete floors and brick walls and the design is such that a fifth storey can be added at a later period at a minimum of expense.

This building is designed to house the laboratories of the Department of Mining Engineering. In the basement are storage bins for ores. On the ground floor much of the original machinery, stamps and crushers, etc., will remain as before. The extension to the north will provide space for mining equipment, an air compressor, rock drills, sampling blocks, and apparatus for the study of ventilation, etc. On the second floor will be rooms devoted to magnetic concentration, flotation, cyaniding, with separate rooms for apparatus serving these, a furnace room, chemical room, balance room and a screening room. On the third floor will be the library and two study rooms, a service assay room and an assay research room, together with other rooms for the staff for research and for exhibits. On this floor also is a locker room and lavatories with shower baths. The fourth floor is given up to assaying. Other features include storerooms, a machine shop and a photographic dark room.

The corner-stone was laid by the Hon. Charles McCrea on Thursday, November 27th, 1930. The ceremony, brief but impressive, was conducted by Canon H. J. Cody, and was attended by many prominent representatives of the government, faculty and profession.

The building is a plain but handsome structure of red brick with brown stone trimming. It is connected to the main Mining Building on College street by an overhead enclosed bridge. The construction was completed in February and the building will be equipped and ready for classes for the opening of the next session in September. No attempt will be made to completely fill the new building with apparatus at once. This will be a gradual process, but in the immediate future considerable new equipment will be installed.

ADDRESS TO GRADUATING CLASS

By Francis Lee Stuart

President, American Society of Civil Engineers

To the Engineering graduates of the University of Toronto, as President of the American Society of Civil Engineers, I am glad to be here and bring with me the greetings of that society.

You are just starting out in life as engineers and if you are fitted for it you are starting a life of adventure and romance which will last as long as you do. You live in an engineering age and I know the future holds many times as great advances as we have had in the past and I think you have a great privilege ahead in being a working part of the interesting things that are to come.

For full enjoyment and interest in what is before you, you have to have physical health, keep fit mentally, and have an objective of value to many. You have to work, and work hard, and that is what makes your pleasures worth while.

Some of you must have been in training while at college. Keep it up as long as you can. I kept such physical trim until I was thirty and was able to do the front and back giant swing and stand flat-footed and turn fair back and front somersaults, besides boxing a few rounds without loss of breath from running away—and I really think that kind of training tended to keep me wide awake and on my toes and that it will help you.

To be mentally fit is a large subject. It does not mean to me saturation with technical knowledge but a state of mind that is normal and which enables us to use our special technical education in an effective way. In ordinary affairs we should not let any idea, feature or phase of our daily life grow out of its proper proportion with other things. We must see things before us as they are, not see four hurdles where there are but three or *vice versa*. State clearly whatever requires a statement and it is apt to point the answer. Have ego but not too much—do not take yourself too seriously. Keep the mind receptive—have an inquiring mind and have curiosity, they both excite the other faculties of the mind and keep them on the job. Know what is happening around you and be a part of it—think of the future, what is coming, what is ahead—dream of things that should be done—just a normal person and mentally fit to do things.

Your interpretation of the technical education you have been receiving has to be verified by experience to be of much value to others, but it should be of value to you at once if it helps you to pick out an objective of value. Think of what the State as represented by the University of Toronto has been spreading out before you—think over the books you have been studying—they did not grow, they represent the knowledge of the ages brought along by pegging and recording progress as it was made and passing it on, so you and I do not have to start at zero on any proved subject, but the how

and why up to now is pegged and is yours for the study. You owe something to the past for what they have given you and the only way you can pay is by contributing your bit as you go along, giving of your time and talents to your State and the world; peg facts as facts and hold them until someone can move ahead from where you left off.

It seems to me that the mental slant that you owe to the future, repayment in kind for what the past has given you, is the cause or the effect of the essential something that we have not yet named, that gives you the impulse, the spark, the desire to do, the will to work, and the will to stand the gaff to do the things that are necessary to take leadership in the profession.

Each of you can help in research work. When you graduate, record the reason why you chose your profession and at stated intervals record why you are an engineer and give those records to your university. They will help some research board that is trying to advance the profession and help you.

There are scores of ways to help others as you help yourself. The Canadian Institute of Engineers is a national society for the benefit of all engineers of Canada. You should be a part of it and give it your working support to make it grow.

By parentage or otherwise you live in Canada. It is a country of great resources and of great unknown possibilities and great opportunities for young men. Canada will grow and it is also certain that engineers and their arts will create much of the national progress and you and the men like you should give the leadership. Everything is here ahead of you, a great stage setting for the adventure, pioneering and romance of engineering.

I want you to feel it is a privilege to be an engineer, and if you will use a part of the mentality with which you create material progress to weigh and formulate the policies upon which our happiness depends, you will be more useful to the world we live in and you will enjoy the mental pleasures and personal growth that come to men who reach for objectives to advance our civilization.

1931

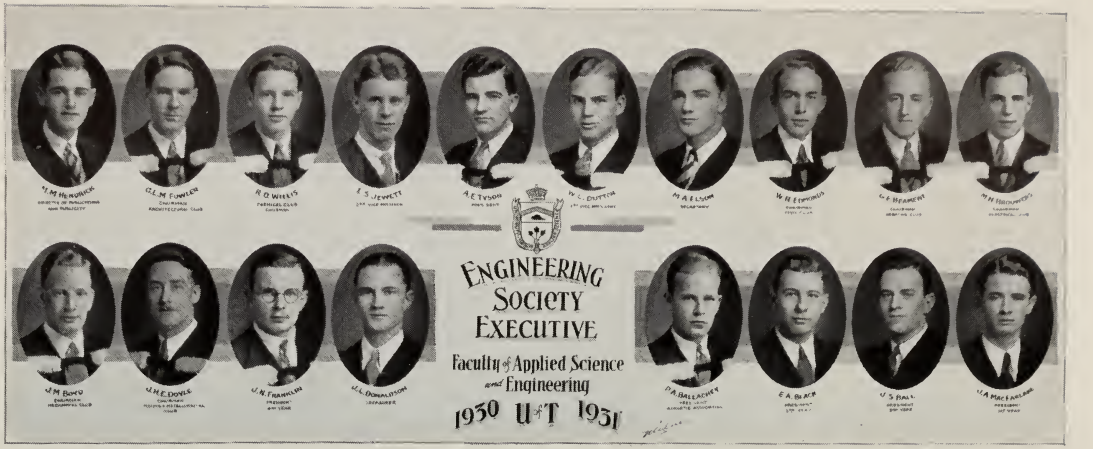
YEAR BOOK

OF THE

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

FACULTY OF APPLIED SCIENCE
AND ENGINEERING

UNIVERSITY OF TORONTO


ENGINEERING
SOCIETY
EXECUTIVE
Faculty of Applied Science
and Engineering
1930 U of T 1931

Engineering Society Elections

About a week prior to Friday, March 6, was when it started and all was not normal again until early on Saturday, March 7. What? Why the big 1931 school election campaign, of course! It started gradually and for the first two days while nominations poured in there were not many outward signs of an election. No doubt during this period many innocent and unsuspecting characters were mystified by the pleasant smiles and hearty greetings with which they were accosted in the halls and drafting rooms by persons whom they could not remember having seen before. The election committee were kept busy placing nominations on the big sign in the hall, for all to see who aspired to prominence.

Nominations closed on Wednesday at noon and at 4 o'clock the usual election meeting was held in C22. This was probably the most orderly meeting for this purpose that has been held in recent years. Due to the influence of the S.P.S. morality squad, the humour that existed was of a pure and simple nature and the candidates confined their remarks to straight electioneering.

Overnight the halls, and even the drafting rooms, took on new colour and for the next two days our friends in Department 4 reaped a golden harvest. By Friday there was no space left for posting signs, so several enterprising hopefuls hitched their platforms to balloons and floated them to the ceiling. The marked absence of bribery and corruption this year was regretted by those of us who had hoped to at least fill our cigarette cases.

When election day dawned, lo and behold! by some strange means the Med's building had taken on new colour. In fact there were quite large areas of beautiful blue, white and gold in various interesting designs.

Shortly after 12 o'clock the Great Hall of Hart House began to fill up with a somewhat livelier crowd than is its custom. The usual diners knew then, if not before, that an event of great importance was taking place. After a hearty meal and a number of songs led by the capable Mr. Workman, the east common-room was taken possession of and the entertainment was ably provided by "Mack" and "Andy."

About two o'clock the voters became anxious to exercise their franchise and the usual triumphant parade to the Little Red Schoolhouse took place. Polling booths were arranged on all three floors of the school building and in the Second year drafting room. The voting was soon accomplished and after a short period of listening to the melodious strains of the calliope, which had, unfortunately, arrived too late to lead the parade from Hart House, the voters wended their way toward the various playhouses for a few hours of relaxation after the serious strain of marking the ballots.

In the evening the scene shifted to the Second year drafting room where the usual frivolities were the order of the evening. Once again the days of Ben Hur were recalled in all their glory and

the various other feats of strength and skill were more than adequate to keep up the spirits of those not taking part. As for those who provided much of the entertainment—well, their's had been downed some time before. This was, in fact, the liveliest party we have ever witnessed in the many years of our sojourn in these parts.

A very popular feature was the showing of movies, taken during the day, of the parade and other interesting incidents, by Al. Williams.

Abundance of sandwiches, apples and cider was provided for those who required nourishment, and, as usual, the apple cores were very handy. About ten-thirty the last results were flashed on the wall and soon after that the tumult and the shouting died—in that location at least. The elections were a thing of the past and the exams a thing of the near future.

J. M. Boyd,
Returning Officer.

Election Results

Friday, March 6, 1931

ENGINEERING SOCIETY

President.....E. S. Jewett
First Vice-President.....E. A. Black
Second Vice-President.....J. S. Ball
Treasurer.....R. K. Little
Secretary.....C. W. Tyson

ATHLETIC ASSOCIATION

President.....R. A. Adams
Vice-President.....H. W. Mason
Secretary-Treasurer.....W. R. Fitzpatrick (Accl.)
3T2 Representative.....H. M. Smith
3T3 Representative.....L. J. Lichty
3T4 Representative.....C. C. N. Strachan

CLUB CHAIRMEN

Architectural Club.....H. H. Roberts
Chemical Club.....A. B. Green
Civil Club.....D. R. McQueen
Debating Club.....R. B. Bryce (Accl.)
Electrical Club.....J. E. Boyle
Mechanical Club.....W. H. Bowes
Mining and Metallurgical Club.....B. S. Crocker

PERMANENT EXECUTIVE 3T1

President.....W. L. Dutton
Vice-Presidents.....A. E. Tyson
A. L. Wilson
Secretary-Treasurer.....F. F. Dyer
Councillors.....P. A. Ballachey
R. O. Willis
M. Ward

EXECUTIVE 3T2

President.....W. B. P. Brown
Vice-President.....F. S. Lee
Secretary-Treasurer.....G. A. Campbell (Accl.)

EXECUTIVE 3T3

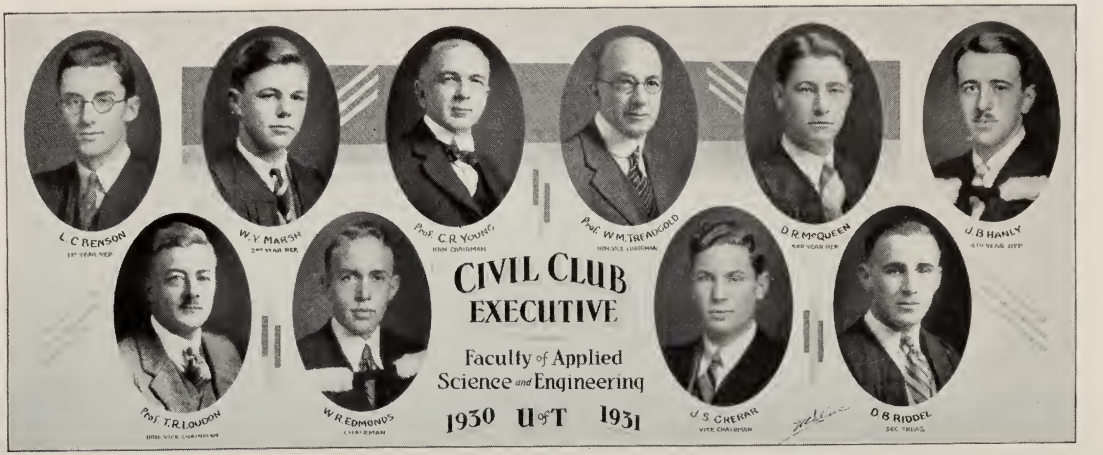
President.....A. S. Barber
Vice-President.....F. R. West
Secretary-Treasurer.....G. E. Ellsworth

EXECUTIVE 3T4

President.....R. W. Anderson
Vice-President.....L. C. Benson
Secretary-Treasurer.....G. R. Black

BRONZE "S"

A. E. Tyson


L. C. RENSON
1ST YEAR REP.
W. V. MARSH
2ND YEAR REP.
Prof. C. R. YOUNG
HON. CHAIRMAN
Prof. W. M. TREADGOLD
HON. VICE CHAIRMAN
D. R. McQUEEN
3RD YEAR REP.
J. B. HANLY
4TH YEAR REP.
Prof. T. R. LOUDON
HON. VICE CHAIRMAN
W. R. EDMONDS
CHAIRMAN
CIVIL CLUB
EXECUTIVE
Faculty of Applied
Science and Engineering
1930 U of T 1931
J. S. CHEVAR
VICE CHAIRMAN
D. B. RIDDEL
SEC. TREAS.

The Civil Club

As another academic year draws to a close it becomes necessary to tabulate the activities of the club for 1930-1931. It has been perhaps not an unusual year in any way, but yet we trust a profitable one.

October 30th, will, I am sure, stand out as a red letter day for those who journeyed to Buffalo. Through the courtesy of the management of the Lackawanna steel mills, we were afforded the opportunity of inspecting their plant. The journey through the steel mills proved most instructive and interesting. The Mechanicals and Electricals also chose this as their goal, making it possible for a real school celebration in one of the theatres in the evening.

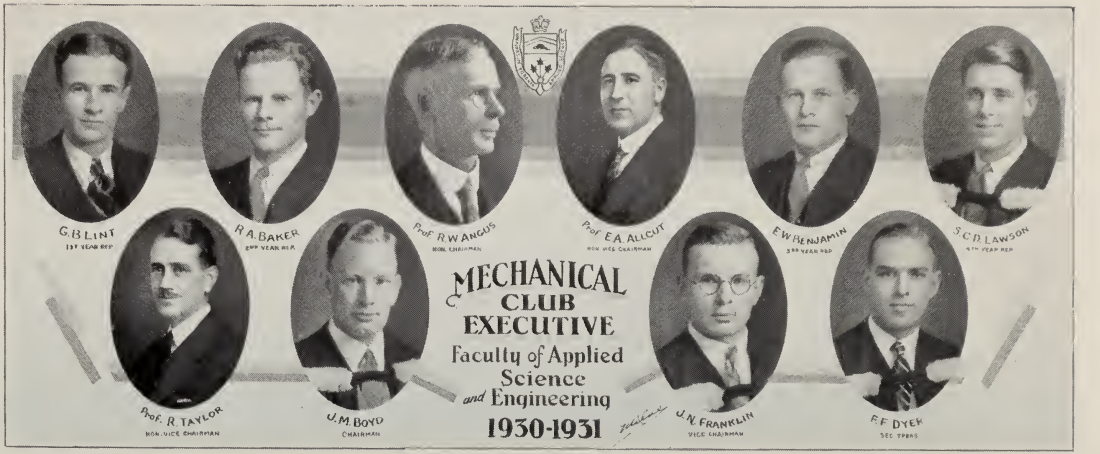
On December 9th, the usual smoker was held in the east common room at Hart House. After a short sing-song, ably assisted by Mal Smith at the piano and Roy Emery on the banjo, a cigar contest was run off. It was indeed a keen struggle and after a process of elimination, the veteran Fourth year smokers emerged on top. It still remains a debatable question whether the Fourth year team, composed of Messrs. Webster and French, did, or did not, dispose of a portion of their cigar through the side window. Mr. W. T. Taylor, as head of the railway and bridge department of the city of Toronto, gave us a very interesting talk on the policies that the engineer should follow after graduation. He also stressed the importance of research work in connection with pile foundation and impact on railway structures. Refreshments in the great hall completed the programme.

The annual dinner took place at Hunt's tea rooms on February 10. Prof. C. R. Young and Mr. E. W. Stearn very humorously replied to the toast to the profession, after which the meeting was turned over to the speaker of the evening, Prof. J. R. Cockburn, who gave an illustrated talk on his experiences in Palestine with the Royal Engineers. The attendance was exceptionally good. In particular may the First year men be commended for the manner in which they supported the club.

The club wishes to express their appreciation to the professors of the department for their hearty cooperation throughout the year and for the time and effort expended on our behalf.

We congratulate D. R. McQueen on his election to the chairmanship and wish him every success in the coming year.

W. S. R. Edmonds,
Chairman


G.B.LINT
1ST YEAR REP.
R.A.BAKER
2ND YEAR REP.
Prof. R.W.ANGUS
HON. CHAIRMAN
Prof. E.A. ALLCUT
HON. VICE CHAIRMAN
E.W.BENJAMIN
3RD YEAR REP.
S.C.D. LAWSON
4TH YEAR REP.
Prof. R. TAYLOR
HON. VICE CHAIRMAN
J.M. BOYD
CHAIRMAN
MECHANICAL
CLUB
EXECUTIVE
Faculty of Applied
Science
and Engineering
1930-1931
J.N. FRANKLIN
VICE CHAIRMAN
F.F. DYER
SEC. TREAS.

The Mechanical Club

The Mechanical Club has now completed its second successful year as an individual unit of the Engineering Society.

The year's activities commenced early last October when the Fourth year made their annual visit to the vicinity of Niagara Falls. On account of the early tie-up of navigation, the trip was made by land instead of by sea. That was quite all right for all but those who travelled in rumble seats. After a morning at Queenston, a good meal at the Falls and a trip through the Ontario Power station and intake, the party crossed the river to visit the plant of the Niagara Power Company, where we were very systematically shown "the largest generators, turbines, etc., in all the world." The Queenston plant needed no advertising. Coming back the cars were full in more ways than one and it is rumoured that Si Enright could not get the windows of his well-known wagon to go down.

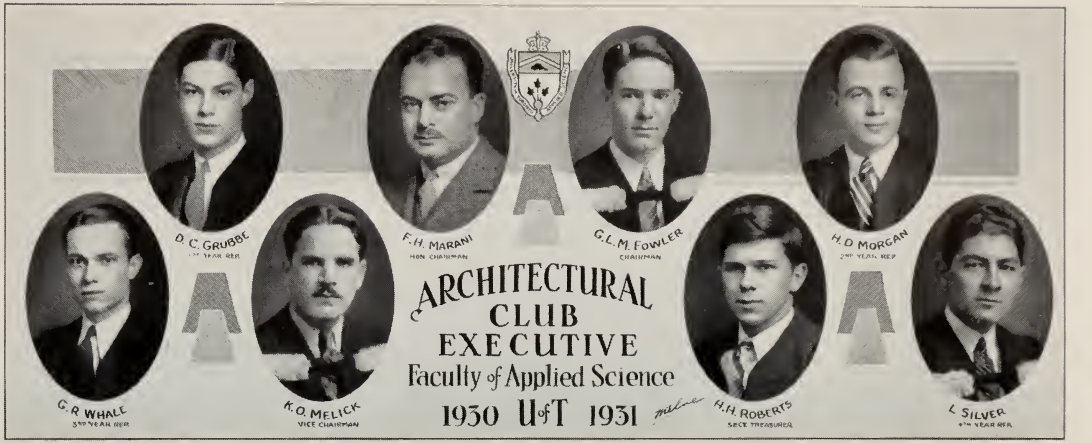
Early on the morning of November 30th, three of the T.T.C.'s newest coaches proceeded westward from Hart House, bearing approximately one hundred ardent Mechanicals bent on exploring the wilds of Buffalo. After arriving at this town somewhat late, at least an hour was spent in trying to determine the exact location of the Curtiss Aeroplane Company's factory; this task was not simplified by the various opinions hazarded by Buffalo policemen. The trips through the two Curtiss plants went very smoothly until someone tried to take a picture of one of Uncle Sam's latest pursuit planes! What! spies? Later in the afternoon we learned how a modern steam-power station à la C. R. Huntley is operated by turning a few dials. The evening was then spent seeing Buffalo as it should not be seen and about 5:30 a.m. we were awakened from sweet repose in the upper berth (commonly known as the luggage rack), to be told that Toronto was the next stop.

Among the more interesting of the short trips taken by the various years were those of the First year to the Goodyear and Can. General Electric plants, the Fourth year to the plants of the Otis-Fensom Elevator Co. and the B. Greening Wire Co. in Hamilton. The whole club also inspected the mechanical equipment in the new Bank of Commerce building.

Two very interesting smokers were a feature of the club's activities this year when Professors Angus and Allcut, respectively, gave illustrated talks on the practical applications of hydraulics and thermodynamics. These talks covered in a most interesting manner various phases of these subjects which do not enter into the lecture courses.

And so the year has passed and the time has come to hand over the reins to a new executive under the leadership of Warren Bowes, to whom we wish all success in carrying on the activities and increasing the usefulness of this club.

J. M. Boyd,
Chairman


D. C. GRUBBE
1ST YEAR REP.
F. H. MARANI
HON. CHAIRMAN
G. L. M. FOWLER
CHAIRMAN
H. D. MORGAN
2ND YEAR REP.
G. R. WHALE
3RD YEAR REP.
K. O. MELICK
VICE CHAIRMAN
ARCHITECTURAL
CLUB
EXECUTIVE
Faculty of Applied Science
1930 U of T 1931
H. H. ROBERTS
SEC. TREASURER
L. SILVER
4TH YEAR REP.

The Architectural Club

The year 1930-31 has been particularly successful for the Architectural Club. This success is due, we feel, not to any change in programme which we have attempted in the past year, but rather to the possibilities which have been exposed.

The year began with the annual "Gull Lake Trip" for the members of the three senior years. Although the enforced absence of Mr. C. W. Jefferys was lamentable, yet, under the tutorship of Professor C. H. C. Wright and Mr. W. E. Carswell, some excellent work was accomplished. The dance held in the dormitory, with the co-operation of the Misses Jefferys and Lumley and the Minden girls, added just the necessary social flavour to a week in the wilds.

Early in December the annual Club dinner was held in Shakespeare-Land Tea Rooms. It was one of the most successful in years, and sixty grads., undergrads., and professors enjoyed a bountiful meal, and the address given by our honorary chairman, Mr. F. H. Marani. During the evening the freshmen were initiated.

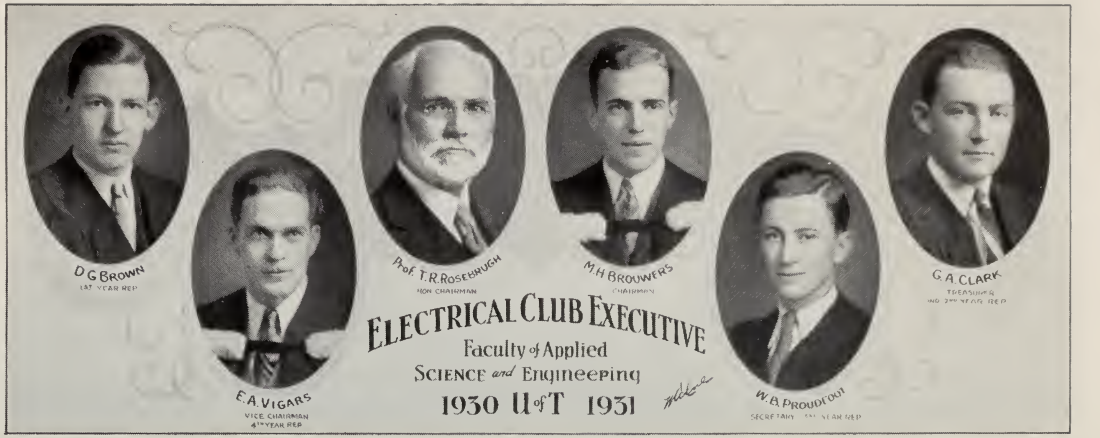
Through the kindness of Messrs. Darling and Pearson, the club had the privilege of inspecting the new Bank of Commerce building. The trip was very interesting and we wish to take this opportunity of thanking those members of the staff of Darling and Pearson who acted as our guides.

On the 26th of February the annual Club dance was held in "Old Spain." About thirty couples were present and enjoyed dancing, and supper à la cabaret at eleven o'clock. The programmes, specially designed for the occasion and done in brown and black, drew many exclamations of delight from the fair guests present.

On various occasions throughout the year we have enjoyed interesting "talks" by prominent architects and engineers and by men closely allied with the profession.

The success of the year's activities was due to a large extent to the co-operation given the executive by both members of the club and outsiders. We trust that this desirable condition will continue and we take this opportunity of wishing the club every success under the 1931-32 régime.

G. L. Fowler,
Chairman


D G BROWN
1ST YEAR REP
E A VIGARS
VICE CHAIRMAN
4TH YEAR REP
PROF. T. R. ROSEBRUGH
HON CHAIRMAN
M H BROUWERS
CHAIRMAN
W B PROUDFOOT
SECRETARY
G A CLARK
TREASURER
ELECTRICAL CLUB EXECUTIVE
Faculty of Applied
SCIENCE and Engineering
1930 U of T 1931

The Electrical Club

According to age-old custom, the earliest event of the year for the Electrical Club was the Fourth year trip to Queenston and Niagara Falls, in which some of the world's finest power developments were inspected. In addition, some of the world's finest sleuths were discovered at the border by several unfortunate schoolmen. However, everybody acquired considerable knowledge one way and another and the day was voted a huge success by all except those who travelled in the rumble seats. It rained all day.

The second big event of the year occurred in the middle of October in which all years took part. The first year hied themselves to Hamilton, where they inspected the Westinghouse plant and the Otis-Fensom elevator factory, the latter creating a very uplifting effect on the members. The Second and Third years braved the wiles of Buffalo in order to see the Huntley station, the Curtiss aeroplane factory, and the Bethlehem steel plant. It is reported that since their trip home a certain fair-sized portion of the falls has been missing.

In order to be different the lofty seniors went in a north-easterly direction, ending up at the General Electric plant in Peterborough, where every square millimetre of floor space was covered and where some members decided that "Peterborough was the place for them."

The evening of November 10 found the major portion of the club members gathered together in Hart House to hear Mr. Burwash of the Bell Telephone deliver a very interesting address on "The Dial System," illustrated by means of working apparatus. After the lecture an intensely mystifying exhibition was given by one of Mr. Thurston's understudies, and some of the audience are still wondering what kind of glue he used to stick the rope together.

The final meeting of the season, early in March, was another "smoker." Professor T. R. Rosebrugh, our honorary chairman, addressed the members of the club, and his talk on "Systematic Thinking" was very timely and one which everybody considered highly beneficial.

And so, with the exams. in mind we conclude this sketchy description of the club's activities for the past year, hoping that the fates deal kindly with us and that next year finds we have attained that for which we are now toiling.

M. H. Brouwers,
Chairman


J. H. SALTER
1ST YEAR REP.
C. E. MACDONALD
HON. CHAIRMAN
J. H. E. DOYLE
CHAIRMAN
C. A. STEVENS
2ND YEAR REP.
B. S. CROCKER
3RD YEAR REP.
M. C. G. MEIGHEN
VICE PRESIDENT
E. O. WITHROW
SEC.-TREAS.
E. N. WARD
4TH YEAR REP.
MINING
and
METALLURGICAL CLUB
Faculty of Applied Science
and Engineering
1930 1931

The Mining and Metallurgical Club

The first club function of the past year was held in honour of the freshman class. Elections were conducted to complete the executive of the club. Each freshman was then formally inducted. The meeting was concluded with songs, yells and food.

The annual trip this year was perhaps the most successful one in the history of the club due to the generous hospitality of Gypsum, Lime and Alabastine, Canada, Ltd. The operations of this organization at Caledonia were visited and inspected in a most comprehensive manner. Through the courtesy of the company everyone was equipped with suitable underground clothes and the descent was made by the inclined shaft. Above ground, the crushing and grinding of the ore were seen, and the processes of preparation that followed. The members then met in the Convention Hall, where lunch was served. A film showing the various applications of gypsum products was thoroughly enjoyed by all. The keen interest aroused by the visit was indicated by the numerous questions and the nature of the discussion which followed. A hearty vote of thanks was then tendered all those responsible for the arrangements of such a successful trip.

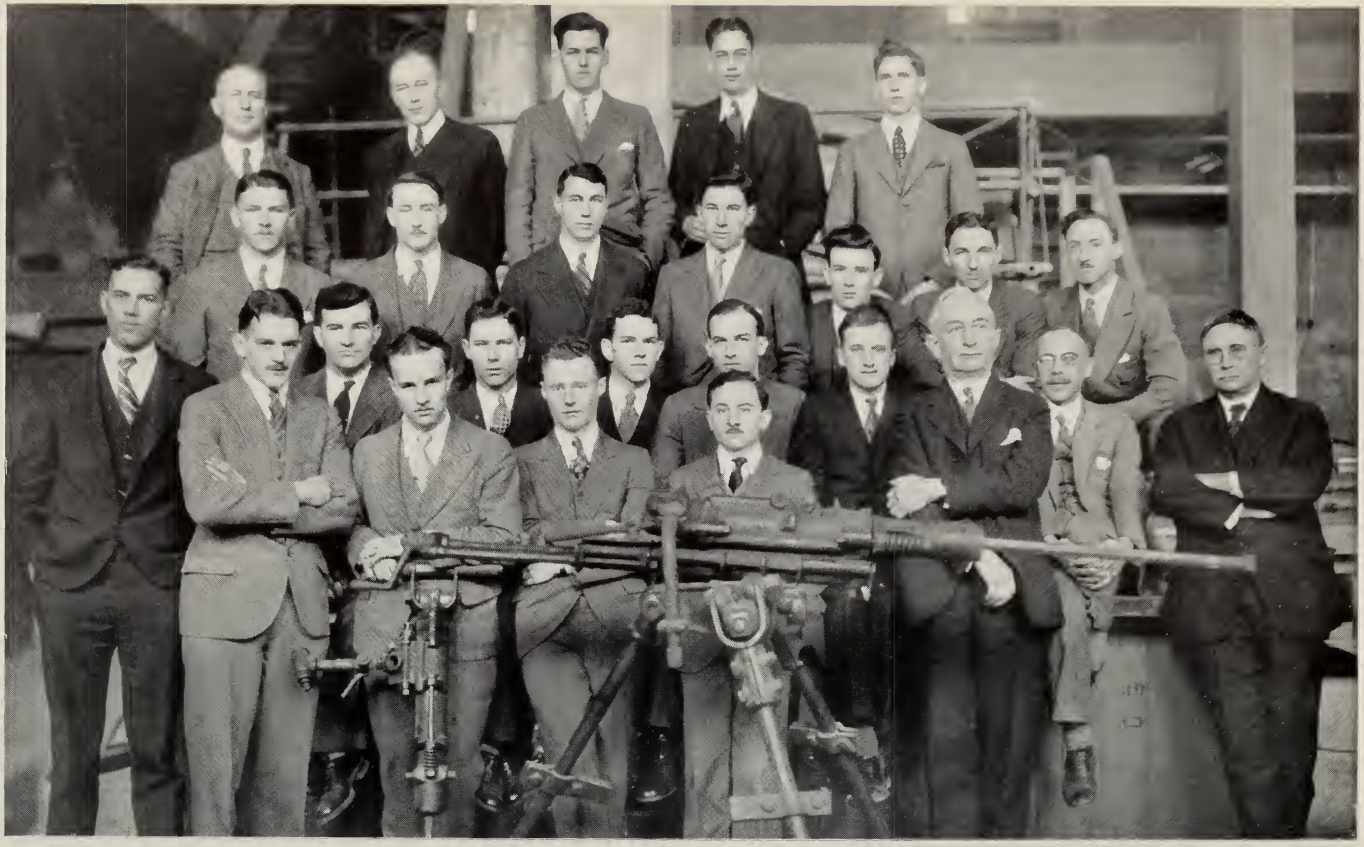
As in previous years, the Mining and Metallurgical Club executed its vigorous dinner programme, four being held in all. The honorary chairman, Mr. C. E. Macdonald, contributed much to the success of these, and his presence at every meeting was sincerely appreciated by the members of the club.

The first dinner was held in November, when the speaker was Mr. Richard Pearce, president of the Northern Miner Press. Mr. Pearce gave a most interesting address on his adventures in the Arctic, which he illustrated by slides. He also explained the method of modern prospecting in the barren lands and told many interesting stories in connection with his unusual trips.

Mr. C. E. Macdonald the honorary chairman of the club, addressed the December dinner, when he described the nature and extent of the recent expansion programme of the International Nickel Company. Mr. E. G. Williams, the honorary chairman of last year, was also present at this meeting and expressed his active interest in the club.

The subject of the February dinner was "Aluminium," when Mr. Banbury and Mr. White, of Aluminium (VI) Canada, were the speakers. Mr. Banbury gave a brief historical background of the subject and described the preparation of the metal. Mr. White continued the address, pointing to the large field of usefulness which this remarkable metal serves and some of the new purposes to which it is adapted.

The final dinner meeting of the year was held in March, when the chief speaker of the evening was M. G. C. Bateman, who spoke in a most pleasing manner on "The Gold and Silver Situation." Mr. Bateman showed a complete mastery of his subject. Mr. R. A. Bryce and Mr. Macdonald were present and contributed much to



FOURTH YEAR MINERS AND METALLURGISTS

Back Row: Prof. I. T. King, Mr. H. L. McClelland, G. H. Gibbs, E. N. Ward, L. V. Whiton.
Middle Row: W. H. Zieman, J. H. E. Doyle, W. D. Thompson, J. B. Butterill, B. R. Awde, M. C. G. Meighen, Mr. S. E. Wolfe.
Front Row: K. M. Brown, I. B. Burk, A. E. Tyson, E. I. Hick, E. W. Gilchrist, R. N. Sexsmith, M. S. Fotheringham, I. G. Pierdon, H. G. Field, R. J. Isaacs, Prof. G. A. Guess, Prof. F. C. Dyer, Prof. H. E. T. Haultain.
Absent: B. L. Alexander.

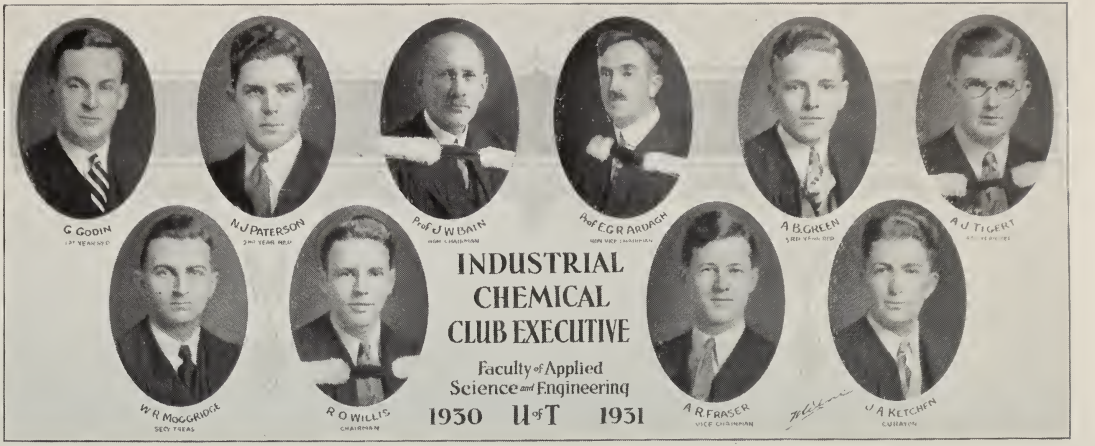
the interest of the meeting. Mr. Bryce told several interesting episodes in connection with the silver industry with which he was intimately associated during the active days of Cobalt.

The Club has enjoyed and appreciated the hearty support shown them by members of the faculty, especially by Professors Haultain, King and Moore. We are particularly indebted to Mr. C. E. Macdonald for his capable support and sincere interest shown throughout the year.

The outstanding social event of the Mining and Metallurgical Club was afforded the members through the generosity of the Association of Women of the Mining Industry. The At Home, which is looked forward to with unusual anticipation, was held on January 31st at the University of Toronto Schools. An unusually large number of members were present and the event was considered by everyone to be the most successful yet.

It is with sincere appreciation that the present executive thanks every member for the co-operation and support shown during the past year. We feel particularly grateful to those members who displayed such keen interest and untiring effort to further the development of the club. In passing on the control of this vigorous organization to the new executive, we offer our hearty good wishes for future achievements.

J. H. E. Doyle,
Chairman


G GODIN
N J PATERSON
Prof J W BAIN
Prof E G R ARDAGH
A B GREEN
A J TIGERT
W R MOGGRIDGE
SEC'Y TREAS
R O WILLIS
CHAIRMAN
A R FRASER
VICE CHAIRMAN
J A KETCHEN
CURATOR
INDUSTRIAL
CHEMICAL
CLUB EXECUTIVE
Faculty of Applied
Science and Engineering
1930 U of T 1931

The Industrial Chemical Club

As the chemical engineer passes from his first to fourth year he finds himself more and more confined to one place—the Mining Building, and even there, the various years are thrown apart in such a way that one can readily understand how he might be looked upon by his brother engineers as being unsociable. However, there is one influence that tends to do away with this imaginary condition and that is the Industrial Chemical Club. It proves that the Chemical is not such an unsociable person after all.

We always feel that spirit of sociability right from the start, on the annual club excursion. This year the busses took us over to Niagara Falls, N.Y., where we first visited the Carborundum Company, witnessed a striking demonstration of the model of the falls, and then had lunch at the Cataract House. During lunch, Mr. Bradbury of the Niagara Hudson Power Corporation, addressed the club on "More Steam for Niagara." The U.S.L. Battery Corporation was next inspected, and then the Niagara Falls Power Company. The Defiance Paper Mill was the last plant to be visited.

In November, a dinner was held at Hunt's. The attendance was good, bringing out the Chemical's social qualities again. Dr. Whitby, director of the Division of Chemistry of the National Research Council, spoke on "Some Opportunities for Industrial Chemistry Research in Canada." Following this absorbing address Dr. Boswell made some very interesting remarks.

A few weeks later, the fourth year men made their annual trip to Longford, Ontario, to see the process of wood distillation in its native haunt. Although it was summer when we left Toronto, it was winter in all its glory up there. The Standard Chemical Company treated us royally to dinner, and afterwards, out in the plant, explained all the mysteries to us. We had a rough old time trying to keep our hats on, on our way home.

At a smoker held in Hart House before Christmas, Professor L. J. Rogers gave us his ideas on "Chemistry in the Prevention of Crime." They were very interesting and entertaining.

The first meeting in the second term was combined with the University Chemical Club in Arts. There Dr. Kay discussed "Poison Gases Used in the Great War." Then a professional entertainer caused a little variation in the programme.

At School Night, the Chemical Club refreshment booth was arrayed in the good old blue and yellow. It sported a mechanical machine for producing eskimo pies, with a background of an elaborate apparatus for distilling synthetic lemonade. What a shame to waste such an apparatus on lemonade!

Dr. Berry, in charge of the provincial division of Sanitary Engineering, gave us an illustrated lecture at a smoker in Hart House. His remarks on "Public Health Engineering" concerned us all as this is one of the important options in fourth year.

FOURTH YEAR CHEMICALS

Front Row: Prof. E. A. Smith, Prof. E. G. R. Ardagh, Prof. J. W. Bain, Prof. M. C. Boswell, Prof. L. J. Rogers, Dr. R. R. McLaughlin.

Remainder, Left to Right: M. W. Mercer, H. F. McFadden, H. W. Owens, W. E. Rutter, A. S. Archer, D. W. Stevens, G. E. MacLean, W. M. Hutcheon, E. V. White, M. S. Kernighan, F. S. Grundy, G. E. Oldham, R. L. Strong, E. Jackson, A. J. Tigert, J. S. McLaren, F. G. Brown, F. Bremner, D. W. Overend, G. F. Rishor, F. Masse, R. W. Lundy, [illegible], W. E. Bayly, R. A. Irwin, R. C. Williamson,

The activities of the club came to an appropriate finale with a dinner held in March at Hart House. Mr. J. P. Bell, director of the Chemical Development Division of the Canadian Industries Limited, told us all about the company and its relation to the chemical industry of Canada. He also gave us advice on going out into industry, which was supplemented by Professors Bain and Ardagh.

We extend our best wishes to the incoming executive and feel confident that Art Green, the new chairman, will have the best of support and success with the club next year.

R. O. Willis,
Chairman

FOURTH YEAR CIVILS

Back Row: E. H. McLean, F. W. Warner, W. L. Dutton, R. M. French, L. A. Kay.
Front Row: W. B. Webster, W. S. R. Edmonds, I. B. Hanly, E. A. Philips, P. A. Ballachey, G. L. Boone, K. S. Moeser.

FOURTH YEAR MECHANICALS

Back Row: I. B. Dowler, M. P. McKay, G. H. McVean, G. E. Beament, J. R. Baillie, W. M. Nicholson, S. C. D. Lawson, W. D. Brownlee, E. L. Burnham, R. H. Clute, B. C. Blizzard.

Middle Row: A. Pasternak, E. L. Bowerman, W. S. Enwright, E. B. Horton, H. H. Dewar, E. I. W. Sheare, J. C. Barnes, B. B. Puddy, B. W. Hulfish, G. W. Jacobi, J. N. Corry, E. W. Montgomery.

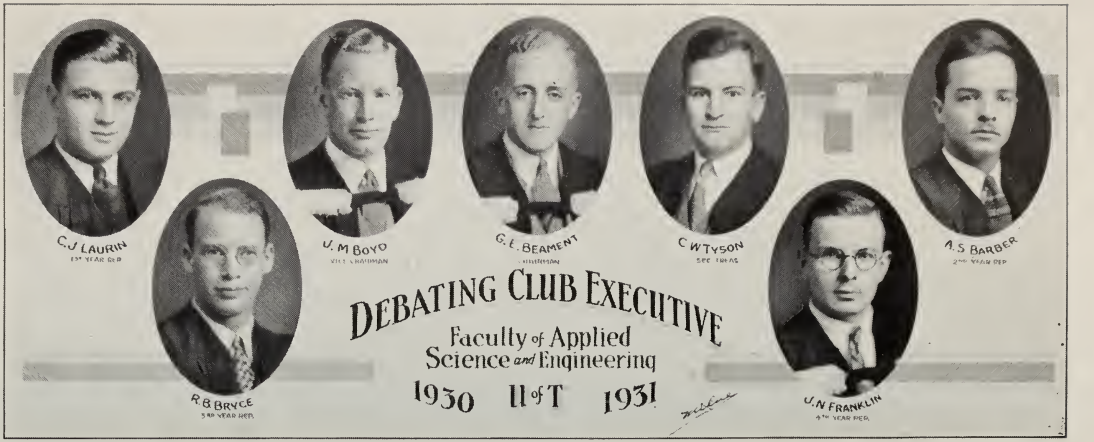
Front Row: A. R. Williams, J. N. Franklin, J. M. Boyd, Prof. W. G. McIntosh, Prof. E. A. Allcut, Prof. R. W. Angus, Prof. R. Taylor, F. F. Dyer, K. J. Joyner, J. R. White.

FOURTH YEAR ARCHITECTS

Back Row: Mr. W. E. Carswell, Prof. H. H. Madill, Prof. E. R. Arthur, Mr. M. Waters.
Front Row: L. Silver, D. I. Reed, I. Richmond, G. L. M. Fowler, K. O. Melick, E. J. Mitchell
Absent: A. J. Hazeland.

FOURTH YEAR ELECTRICALS

Back Row: M. H. Gillson, H. R. Graff, J. Poppleton, M. K. Evans, A. E. Graham, S. C. Fotheringham, D. B. Ireland, J. W. E. Thomas, R. L. Mooney, H. Popplewell, A. M. Cutt
R. J. Anderson, A. L. Wilson, R. F. Wright, E. A. Vigars.
Middle Row: P. H. M. Baker, H. E. Davison, J. Davidson, L. H. Lef, A. G. Brenneman, A. L. Graham,
R. H. Hillery, T. Henry, A. J. Sirdevan, J. W. Young, J. D. Haggart, J. W. Stiles.
R. F. Lambton, C. E. Browne, G. S. Faris, N. C. Cowie, M. H. Brouwers.
Front Row: B. W. Switzer, M. Ward, Mr. W. F. Hachnel, Prof. V. G. Smith, Prof. T. R. Rosebrugh,
Prof. H. W. Price, Prof. A. R. Zimmer, Mr. R. J. Brown, Mr. B. deF. Bayly.


C.J LAURIN
R.B BRYCE
U.M BOYD
G.L. BEAMENT
C.W TYSON
U.N FRANKLIN
A.S BARBER
DEBATING CLUB EXECUTIVE
Faculty of Applied
Science and Engineering
1930 U of T 1931

The Debating Club

The opportunity offered by the Debating Club to all Schoolmen has been a much worked theme for the literary swan songs of retiring chairmen, apparently with rather dubious results. In the first respect we run true to established form; in the latter we optimistically hope for more.

If we, as engineering students, are forced by our training into an entirely utilitarian viewpoint on our activities, support of the Debating Club can still be readily solicited on that basis. In this respect it is of interest to consider some statements made regarding engineering education by several prominent industrialists on the occasion of the dedication of the new Packard laboratories at Lehigh University:

M. S. Sloan, president of the New York Edison and Allied Utilities—"The utilities want technical graduates who aren't all technical. They want men with imagination and the ability to learn and think. Men with a background and education broad enough so that technical training assumes its proper place but does not become the whole. The electrical utilities need such men and constantly will need more of them."

Alfred R. Clancy, president of the Oakland Motor Car Co.:—"My own stand in the matter of cultural subjects is very positive. No matter what he takes up, a man's success depends upon his salesmanship. This being true, it is most important that he acquire the poise and polish that general culture gives him, in order that he may make the finest impression of himself and his ideas."

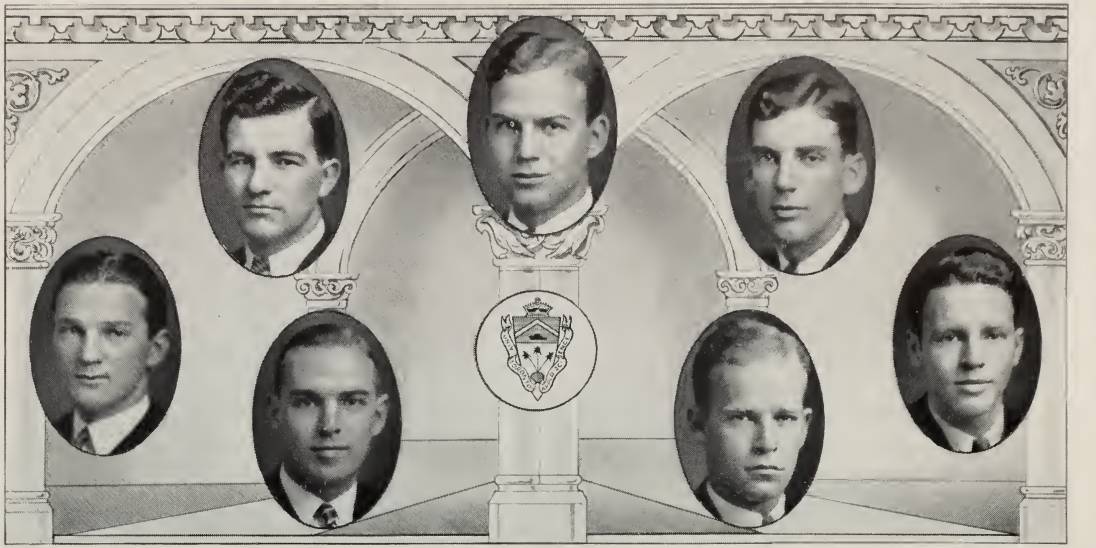
It is towards the attainment of these very necessary factors arising from the correct balancing of the educational process that the policies of the S.P.S. Debating Club are directed.

During the past year the activities of the club have been most encouraging. Alternating discussion groups and formal debates have been held weekly, and both types of meeting have proven most stimulating to those present. At the close of the fall term, the annual dinner of the club was held, on which occasion we were fortunate enough to have as our guest speaker, Dr. J. R. P. Sclater, who spoke on "Speech and Speech-making."

The Sedgeworth trophy for inter-year debating was won by Third year, represented by M. M. Hendrick and R. B. Bryce, who, in the finals, successfully defeated the motion, "Resolved, that the influence of the United States is a menace to Canadian nationality," most staunchly upheld by H. R. F. King and A. W. Troup of First year. The impromptu speech night was won by J. M. Boyd, who spoke most convincingly on "The necessity of an underground railway system for Toronto."

The club is greatly indebted to the continued assistance and support of Professors Alcutt, Taylor, Wright and Zimmer. They have undoubtedly assisted those interested in that seemingly distant objective of all speakers,—that happy and most valuable ability—"To stand up, speak up, and shut up!"

G. E. Beament,
Chairman



PERMANENT EXECUTIVE, 3T1

W. L. Dutton, *President.*

A. E. Tyson, *Vice-President.* — A. L. Wilson, *Vice-President.*

M. Ward, *Councillor.* — R. O. Willis, *Councillor.*

F. Frank Dyer, *Sec.-Treas.* — P. A. Ballachey, *Councillor.*

Message of the Permanent Executive 3T1

We were told, as freshmen, that we were embarking on the four best years of our life. We all agree that this prediction has been fulfilled in no meagre way, and now we find ourselves looking forward to a continuance of our associations as alumni.

We might well feel proud of our class and the record it is leaving behind. The revival of old-time initiations by 3T1 will long be remembered. Our year has given its share towards academic, athletic and social achievements during the four sessions spent in the Little Red School House.

The job of your permanent executive is to keep 3T1 alive after graduation. If we are to succeed, we must have the co-operation of every man in the year. We all want to retain the warm friendships that have developed in the lab and lecture room. One of the best ways to keep in contact with the rest of the year is through the University of Toronto Monthly, which is issued by the Alumni Federation. We strongly advise that every man subscribe to the Monthly and be sure that his subscription does not lapse. Should you be located in a strange town—join the local branch of Alumni, or if there is none, your secretary has a list of subscribers to the Monthly and would be glad to let you know if there are any School Grads residing there.

Be sure to let us know if you change your address at any time, and also let us know should you hear of anyone who has been married, or who is sick or in trouble, etc.

This executive wishes you all success in your future endeavours. Your achievements will reflect credit upon your University, Faculty and Year, and will be a monument to the years of "study" at school.

W. L. Dutton,
President.

F. Frank Dyer,
Secretary-Treasurer.
164 Colin Ave.,
Toronto 12.


A. L. WILSON
ATHLETIC REP.
J. B. HANLY
CIVIL REP.
J. N. FRANKLIN
PRESIDENT
DEAN C. H. MITCHELL
G. H. GIBBS
VICE PRESIDENT
E. N. WARD
MINING & METALLURGICAL REP.
S. C. D. LAWSON
MECHANICAL REP.
L. SILVER
ARCHITECTURAL REP.
A. J. TIGERT
CHEMICAL REP.
J. B. DOWLER
SECRETARY
FOURTH YEAR
EXECUTIVE
Faculty of Applied
Science
and Engineering
1930 U of T 1931
J. B. MACPHERSON
TREASURER
E. A. VIGARS
ELECTRICAL REP.
B. L. ALEXANDER
TORONTONENSIS REP.

3T1

September, 1927, saw an influx of some hundred and ninety very meek and very wild human beings, forming the class of 3T1, which was then considered to be the largest since the "War year."

Under the able leadership of "Tommy" Wilson, 3T1 forged a sterling reputation for "throwing" parties, a reputation which has been lived up to in succeeding years.

Our sophomore year opened to find "Dinny" Traynor at the helm, capably assisted by Bert Tyson. Under this regime initiations were revived in fine style, to the enjoyment of all—freshmen included, a distinct and undying "School spirit" being the outcome of this pleasing ceremony.

Jack White led the Junior year successfully through the reversing stresses of optimism and pessimism, until we emerged in our final semester to neglect the call of retrospect and intently view that of prospect.

Nor have we been idle in university activity. Our ample representation on all teams has won for the individuals concerned the appreciation of the year as a whole, and for the year as a whole the backing of School in general. To those who come under this category we owe a debt of gratitude, for it is through them that others judge our class and come to the conclusion that 3T1 is a "good year."

J. N. Franklin,
President

3T2

We are drawing to the close of a year which has seen many grave national crises. Finance, atheism, communism, the Varsity, all have been coped with, and there remains but one yet to be met —the final exams. On looking over this past year we see that it has been an eventful one for 3T2.

With due reverence to the Civils and Miners, let us first mention Gull Lake. Here startling discoveries were made. Dunc McQueen blazed forth as a poker player of repute (disrepute). Tommy Wilson became famous overnight. Many of the miners affected a deep interest in the peacefulness of the metropolis of Minden. Crocker took the silver pie plate for athletics. As disciples of the gentle art of fishing, may we name Lytle, Boland, Bryan and Black.

Remember now your first few weeks of school: first, the painful operation of paying fees and buying books; next, the regret that, as a dignified Junior, you are supposed to be above mixing it with those common sophs and that motley horde of frosh.

Our first year party, a so-called "Turkey Trot," was staged at Parkdale Canoe Club on November 6. The engineers, men of the

hairy arm and brawny chest, displayed remarkable agility in treading the light fantastic

Next, there was a rather dull period of learning This interval was punctuated from time to time by some startling statements. One gentleman told us that the friction line always goes down. Now, we had proved conclusively in our lab. the previous day, that it can go up. Either one of us is wrong! Another gentleman alarmed us by saying that isothermal compression is more economical than adiabatic compression. Think of it, gentlemen! This may be the cause of the recent financial compression.

3T2 has been active in athletics. On the intercollegiate rugby squad our honour was upheld by the worthy D. Henderson Traynor. Crocker, Britnell and Reid starred on the Orphans. Adams and Smith did us noble in the track events. Hayhoe and Crocker succeeded in making the intercollegiate water-polo team, which lost by a small margin to McGill. Withrow and Powell were two of School's flying fish in School's bid for interfaculty swimming honours.

After those lamentable exams at Christmas, we were plunged into a mêlée of social functions. Prominent among these was our own Lucky Number dance. A novelty dance if there ever was one! We will treasure in our memories such pictures as Ned Ward cruising about with a little Scotch cap perched on his manly brow; Professor Treadgold on his knees heaving our mammoth dice for the lucky number; Professor Allcut expounding on the relative efficiencies of the Carnot cycle and the bicycle. All these and many more combined with the tuneful ditties of the Varsity Entertainers to make the evening a howling success.

And now we have had our elections. To Bill Brown, Fred Lee, and Gord Campbell, we throw the torch. The best that we can wish them is that they receive as good support in the coming year as the retiring committee has had in the past one. All power to our new executive!

Ernie Black,
President

3T3

When the preliminary rush of hand-shaking was over in the fall, we realized that the old original class had not returned 100 per cent. strong. Such is the fate of every year, and we are sorry to lose the men who failed to turn up. Of course, with the opening of school came the time-honoured problem of initiating freshmen. Since this had been a source of concern to the executive for a couple of weeks, some ideas were already formulated. A few scraps were staged before the eventful night, but on the evening of October 16, one of the best initiations in years was precipitated. Nobody was hurt (much) and all look back on it with a good deal of pleasure.

The old Soph-Frosh banquet in its usual form was not held this year, for well-known reasons of economy. We can't expect to refurnish all the hotels in town. So the first year gave a dance in our honour in the crystal ballroom of the King Edward. It was a very fine party and on behalf of 3T3 I want to thank them very much. This was hardly over when we were accused, along with the freshmen, of raiding Burwash Hall with great effect.

Then football held our attention for some time. We saw two of our men, Fitzpatrick and Elson, back on the big team again. When hockey started we put up Fred Murray and Don Smillie, and were proud of Hal Collins as senior cager.

In the interfaculty assault we had Fell, Bannister, Elson and McCattie, the first two of which are intercollegiate title-holders for boxing and wrestling, respectively. We have a large percentage on Junior School hockey and rugby, so altogether ours is an outstanding year.

We mustn't forget the year party we held in the roof garden of the Royal York. This was a huge success and the clamour for tickets was terrible. However, we held the attendance under check and a dance resulted which drew praise for weeks after.

When Christmas holidays and exams were over all was well and ready for the Junior School At Home. Those who attended this function proclaim it as positively the best of its kind. The committee did its level best and not a detail was left undone. We are sorry the support was not stronger, but no one need make excuse for the dance. It was a wow!

It has been a genuine pleasure for me to have been allowed to act as president of this class. The rest of the executive has been a wonderful unit and I know you made no mistake in choosing them. I want to thank these men for their indispensable help at all times. You have elected a good executive for the next year and I hope they get the support I have.

Stewart Ball,
President

3T4

Not long ago, three hundred and thirty green ties floated, or rather bobbed, through the dark corridors of the "Little Red Schoolhouse." We, the proud wearers of these, soon learned, through close, personal contact, the finer uses of the many strategically-placed taps. Only our spirts remained undampened.

One dark and frosty night, the climax of hostilities was reached. To the reassuring accompaniment of barrel staves, vigorously smacked on desks, we were herded in our own drafting room and escorted to the unknown haunts of the mighty Sophomores. Here we were well scoured with generous applications of soap, both outside and in. But, despite the lingering taste of shaving-cream, Epsom, and raw cod-liver oil, full justice was done the feast prepared at Hart House.

It was on this memorable evening that the offence, resulting in the raid on Burwash Hall, was incurred. We hesitate to mention the extent of our numbers in the attack on the "Vic" stronghold; let it suffice that we were well represented and did our best to uphold the honour of School.

To show our sportsmanship and lack of ill-feeling, we treated the Sophs to a real, "bang-up" party at the King Edward Hotel. This proved a very popular affair—in fact, a free dance for the school in general.

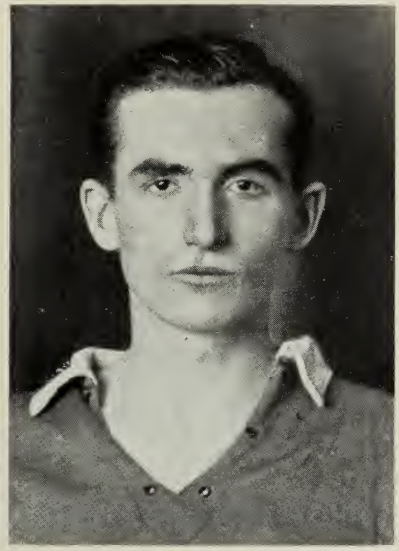
Our first year party took place out at the Parkdale C.C. The music by the Varsity entertainers could not have been better, and with the added attractions of novelties, lucky numbers and punch, everybody spent a lively and enjoyable evening. The only complaint received was that it "bust up too soon."

The year was well represented in athletics, nearly fifty of our men playing prominent parts on both School and Varsity teams. The many merits of those playing for School are lauded under the teams on which they played. The Varsity Junior rugby team owe a lot to the earnest efforts of C. Austin, Monsaroff, Scott and Webber. Hodgson and Black both played good hockey for Varsity Juniors.

The Junior School At-Home, held shortly after the Christmas recess, proved a most enjoyable affair for those who went. It is more fully "cracked up" elsewhere.

It is with the utmost confidence and sincere good wishes that we hand over the chair and cheque-book to R. W. Anderson, L. C. Benson and G. R. Black. Theirs is the task of "educating" the new Frosh—a solemn, however unpleasant, duty to perform.

J. A. Macfarlane,
President



ALLAN ALBERT LAWRENCE

The class of '33 experienced a real loss in the passing of Allan Lawrence on Saturday, February 21st. It was during a work-out on the track, that, entering into the spirit of the race, he sprinted ahead and set a fast pace for several laps. While he still appeared to be running easily he suddenly collapsed and never regained consciousness.

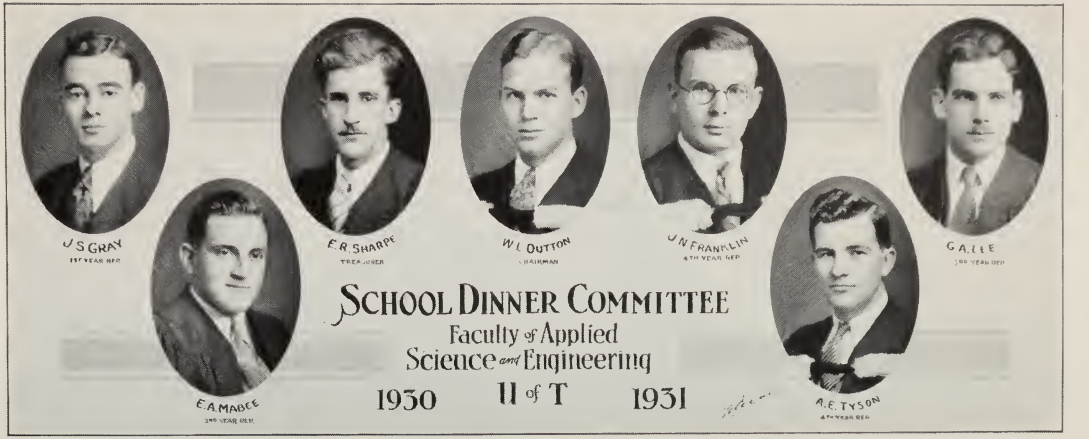
Allan was born in Alliston in 1907 and received his elementary and high school education there. During this time he took a very active part in athletics and held the senior championship of the school for some time.

After his family moved to Toronto he was employed with the Gutta Percha Rubber Company. Following a natural desire, however, for electrical work he accepted a position with the Hydro-Electric System. He showed such remarkable ability in this line that he soon received advancement.

Realizing the possibilities of this calling, he entered University with the class of '33 in Electrical Engineering to better equip himself for his position. In his Freshman year his record was well above the average, and his work done this season showed every prospect of an honour year.

To the members of his year, and especially to those directly associated with him, he will always be remembered for his keen interest in his work and play.

He was every inch a real sportsman and will always be thought of as a gentleman whom we are proud to have known and a friend that we are deeply grieved to have lost.


J S GRAY
E R SHARPE
W L DUTTON
J N FRANKLIN
G A LEE
E A MABEE
A E TYSON
SCHOOL DINNER COMMITTEE
Faculty of Applied
Science and Engineering
1930 II of T 1931

The School Dinner

Traditional School spirit was again made manifest when 646 Schoolmen assembled in Hart House for their forty-first annual dinner.

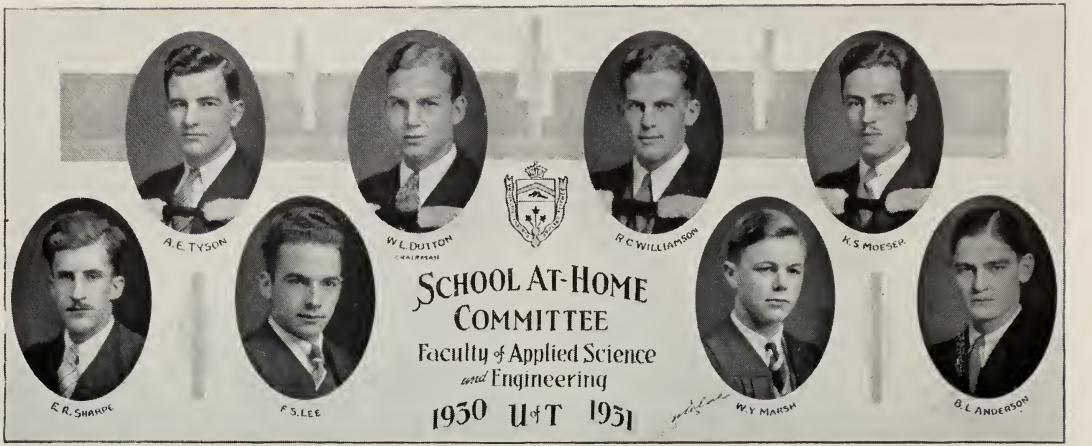
The evening's programme was prefaced by the "Psalm of Life," "Engineers," and "Bible Stories," conducted as usual by ever-faithful "Worky." President Tyson, with a few remarks, opened the proceedings, and toasts to the University, Faculty, Profession, and Sister Societies, were very ably proposed by Ted Beament, Gerry McVean, John Franklin, and Panay Ballachey.

We deeply regretted the absence of Sir Robert Falconer, due to his recent illness, but were fortunate to have Dean DeLury reply to the toast to the University in his stead. Dean Mitchell, in his reply to the Faculty, recalled the night of the first School dinner, which was indeed interesting. Dr. T. H. Hogg, an eminent School graduate, responded to the Profession, setting forth the essential ideas which an engineer must keep before him. Representatives from McGill, Queen's and Western brought greetings from their societies.

Jim Boyd introduced the speaker of the evening, Mr. E. W. Beatty, President of the C.P.R. Seldom has anyone received such attention as accorded Mr. Beatty, who proved himself a most interesting and forceful speaker. In the course of his address, Mr. Beatty traced the essential features of the C.P.R.'s organization, and outlined the railway's contribution to the national life. To say the least, the meeting was entertained in a manner far above expectations and at the same time received the benefit of a most instructive and inspiring address.

So concluded one of School's best dinners; in fact, one might go as far as to say the best dinner at Varsity this year, and we look forward with enthusiasm to an equally successful dinner next year.

W. L. Dutton,
Chairman


A. E. TYSON
W. L. DUTTON
CHAIRMAN
R. C. WILLIAMSON
K. S. MOESER
E. R. SHARPE
F. S. LEE
W. Y. MARSH
B. L. ANDERSON
SCHOOL AT-HOME
COMMITTEE
Faculty of Applied Science
and Engineering
1930 U of T 1931

The School At Home

The annual school At-Home was held at the Royal York Hotel on February 20, 1931. Three hundred and fifty couples attended this year's function, which proved to be one of the most successful affairs in the Engineering Society's history.

The concert hall, where Romanelli rendered popular numbers which met the utmost approval of even the most discriminating, was very effectively decorated with wall lights of blue and gold as well as novel effects.

Supper, served at midnight in the banquet hall, was attended by much frivolity and a delightful repast. The guests expressed their satisfaction by numerous "Toike Oikes" and even a feeble "Epistaxis" which was almost immediately drowned by a thunderous din of most every conceivable noise.

McGill, Queen's, Western, O.A.C., McMaster, as well as other faculties on our own campus were represented.

The patronesses were Mrs. C. H. Mitchell, Mrs. C. R. Young, Mrs. R. W. Angus, Mrs. C. H. C. Wright, Mrs. L. J. Rogers, Mrs. H. W. Price and Mrs. G. A. Guess.

The Junior School At Home

The grand social splurge of Junior School went over in a big way on January 21, 1931, in the crystal ballroom of the King Edward. The guests were received by Mrs. C. H. Mitchell, Mrs. E. A. Allcut, Mrs. R. Taylor and Mrs. W. J. T. Wright. The happy couples oozed about to the dreamy syncopation that flowed from Stan St. John's twelve-cylinder melody machine. The lights were turned low and a spotlight glistened on the great crystal hanging above the centre of the hall. Dances were exchanged until about 11.30. Tables were set in the blue room and in the compartment below the gallery, to which all retired. A colourful assortment of hats and novelties decorated the tables and austere gentlemen took on the appearance of everything from jockeys to Hindu princes. After supper came a lucky number dance in which all but three couples were called from the floor. The remaining three gentlemen, one of which was Professor Cockburn, then guided toy automobiles with breathtaking speed across the dance floor to a close finish. The winner secured for his lady friend a perfume mist and for himself a cigarette lighter. It is rumoured that the bookmakers were busy among the spectators prior to the race, but none approached any member of the committee. Dancing continued to wonderful music and little light until 2 a.m., when the guests left with great reluctance. The committee as listed on the programme consisted of J. S. Ball, A. S. Barber, R. K. Little, R. W. Mancantelli, J. A. Macfarlane and E. F. Macintyre.

J. S. Ball,
Chairman

"SHALL SCHOOL GO TO GUELPH?"

"WE ARE—WE CAN—WE DO!"

School Nite

This gay event, probably the largest and most democratic of all School's social events, was held in Hart House on Tuesday, January 27, under the genial patronage of Dean and Mrs. C. H. Mitchell, Professor and Mrs. W. M. Treadgold, and Professor and Mrs. T. R. Loudon. At the appointed hour (more or less) seven hundred and forty-seven couples stormed the long-suffering "south-west" door and scurried about the corridors seeking out the great variety of entertainments. Alumni and members of the staff mingled with hordes of undergraduates in an atmosphere of merriment.

Ken Joyner molded his mechanical confreres into a body of sage stern counsellors. That worried body dealt with sundry problems incidental to the transfer of S.P.S. to the home of the Aggies. By word and gesture they smoothly demonstrated the advantages and disadvantages of such a momentous step.

A highly humourous but none the less typical cross-section of Gull Lake life was placed on animated exhibition to packed houses. The actors, so absorbed in dramatics that they neglected engineering principles, reached the peak of their animation when the stage collapsed under its hilarious burden. This, however, only added to the fun and things were soon in order. "The show goes on."

World affairs were by no means neglected. Hundreds of sadistic adventurers squirmed their way into the east common-room, there to witness, with fiendish delight, the meting out of justice to those scheming rogues, the "Rushin' Engineers."

Bruce Alexander, master of the water polo hounds, organized a keenly contested game between Senior and Junior School. So expert were the competitors that an extra ball was added to complicate the play. Novelty aquatic events added to the fun.

Joe de Courcey and twenty-two of his expert aides, ably assisted by a man and a monk (or two monks, or two men) provided excellent music for the remainder of the evening.

As the tower clock chimed the unwelcome hour of one, Stunt Night faded to a series of pleasant memories. The revellers trooped reluctantly homewards and Hart House was silent once more.

Special thanks are due to Mr. J. B. Bickersteth and his zealous staff and to the members of the committee for the complete success of the event.

M. S. Fotheringham,
Chairman


FACULTY of APPLIED SCIENCE & ENGINEERING
R. B. BRYCE
3RD YEAR REP.
W. S. SMITH
2ND YEAR REP.
M. M. HENDRICK
EDITOR
TOIKE OIKE
1930 STAFF 1931
M. McKILLOP
2ND YEAR REP.
C. L. WALLBRIDGE
1ST YEAR REP.

Toike Oike

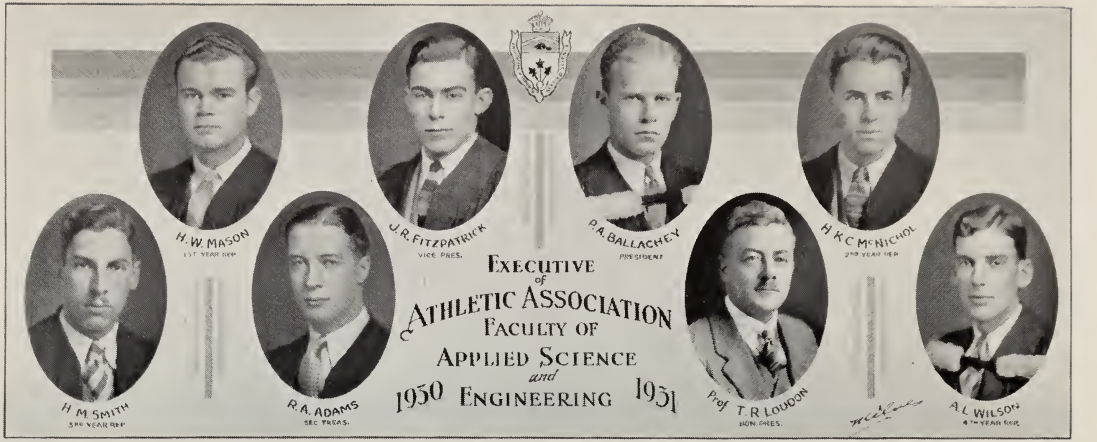
Who would have thought, that sunny afternoon when Toike Oike appeared amid a world of bewildered frosh, that this venerable institution of brotherly guidance would invoke the frowns of the powers that be? But, alas, it tried overhard to please the people, forgetting perhaps for an instant that the freshman is not to be credited with the wisdom of the Soph. And so history was made, and all the campus heard the tale of Toike Oike during the next two months—how Bill Algie was suspended; how petition followed petition to no avail; and how an appeal to the Senate upheld the Faculty Council.

There is left to regret two things: that the Engineering Society as a body was not permitted to accept the responsibility for the action of one of its members, as it tried to do, and as it would logically be expected that it should be able to do; and that the discovery of this limitation of its power was not made without the too-drastic penalizing of an individual.

Thereafter a chastened Toike Oike appeared—considerably expurgated and perhaps to some, therefore, a trifle boring. But the editors tried to provide some conpensating features. Each issue was built around a contribution of serious interest from one of the staff or graduate body and a masterpiece in lighter vein culled from local talent. And on all who responded thus effectively to our not overly-welcome request for copy, we invoke our gratitude.

Seven issues in all were printed. None of the last six caused a riot, but they fitted into the scheme of things and did their bit to make the events they were connected with move smoothly. The staff was somewhat larger but functioned well, struggling against such trials and tribulations as boards of censors, club chairmen, and the limited area of four brief pages. There is material there which should produce a good paper next year. May its contents be more worthy of the trouble of being "published every now and then."

MAX HENDRICK,
Editor


H. W. MASON
1ST YEAR REP.
J. R. FITZPATRICK
VICE PRES.
P. A. BALLACHEY
PRESIDENT
H. K. C. McNICHOL
2ND YEAR REP.
H. M. SMITH
3RD YEAR REP.
R. A. ADAMS
SEC. TREAS.
Prof. T. R. LOUDON
HON. PRES.
A. L. WILSON
4TH YEAR REP.
EXECUTIVE
OF
ATHLETIC ASSOCIATION
FACULTY OF
APPLIED SCIENCE
and
1930 ENGINEERING 1931

SCHOOL ATHLETICS

The School Athletic Association

During the past year our school athletes have managed to gather in four championships and were unfortunate in not capturing a greater number. In practically every sport the teams have won their groups and in many have proceeded to win the finals.

A great deal of credit must be given to the boxers and wrestlers for their fine efforts. The new men especially gave splendid exhibitions in winning the Junior assault, and then carrying on to win the Senior assault, along with the old standbys. They defeated O.A.C. by the small margin of one point and are justly termed champions.

The track squad were again successful in the outdoor meet this year and ran up a fair point margin over U.C. However, in the indoor track the positions were reversed, and next year a more decided effort should be made in these events.

The gym team this year tumbled their way to the interfaculty championship. Great credit is due to these men, who worked very hard for the school cause.

In other sports we were not so fortunate but mention must be made of the Junior School rugby and hockey teams, who were both finalists. These teams fought hard and cleanly and only lost out to teams with greater experience. The managers, McNicol and Gibson, deserve great credit for the fine showing that their teams made.

This year the rowing title strayed for the first time in history. Next year it must come back home again for another long stay.

The other managers have rendered very faithful service and have given of their time very considerably. The members of the executive have done their share and will carry on next year in higher positions, under the direction of Ralph Adams as president of the association.

May I thank all the men who have turned out and played for the school teams and wish them every success in their athletic events of next year.

P. A. Ballachey

SCHOOL "T" HOLDERS, 1930-1931

Back Row: W. D. Smith, M. A. Elson, I. M. Boyd, E. A. Peaker, W. A. Connolly, M. Ward, G. T. Gregg.

Front Row: I. K. Chalmers, C. E. Bannister, R. A. Baker, A. E. Tyson, J. R. White, J. R. Fitzpatrick, R. A. Adams, H. M. Smith.

School in Intercollegiate Sport

With the first call for candidates, many schoolmen turned out for the Senior Intercollegiate teams and played prominent parts during the year '30-'31.

With the Senior Intercollegiate team, John Fitzpatrick and Don Traynor were regular men on the secondary defence. Jack White and Ken Peacock broke up opposing plays with distinct success, while Mal Elson was a bear for tackling backfielders.

Earl Davey, Johnny Burke, Carl Britnell, Bun Crocker, Doug Smith, Rog Baker and Polar Stringer all played many good games for the Orphans of last year and are good prospects for the Intercollegiate team.

With the track men, Adams and Connolly were shining lights, with Peaker running them closely for the honours. Hal Collins and Ed. Hymmen were prominent in the jumps. Duff Thompson and Mal Smith ran in the 440 and on the relay, while Panay Ballachey helped Peaker out in the weight events.

The intercollegiate crew had four schoolmen. Irv. Chalmers as coxswain was a genius for judging strokes, and Algie, Peaker, and Boyd gave noble support in the place where beef counts.

With the soccer players, Ward and Gregg were stalwarts of the team and turned in two good games against McGill.

With the boxers and wrestlers the schoolmen were outstanding. Tell and Bannister were successful in winning their classes, while Brownlee, Fields and Strachan also represented Varsity.

Smillie and Murray performed smartly for the senior hockey squad, and Clute played centre for the O.H.A. B team that played in the group finals.

Our senior basketball players were Hal Collins, Earl Davey and Ted Douglas. They turned in many good games on the trips and in their league fixtures.

School had a large representation on the polo and swimming teams. Hayhoe and Crocker were with the former squad, while Towers, Withrow and Bell swam for the latter.

These men have played well during the past year and in the future may their success be as great as in the past.

SCHOOL OUTDOOR TRACK TEAM

Back Row: B. D. Puddy, I. I. A. Howe, E. A. Peaker, E. R. Eaton, E. B. Hymmen.
Front Row: H. R. Collins, H. M. Smith, P. A. Ballachey, Prof. E. A. Allcut (*Hon. Pres.*), W. D. Thompson (*President*), R. A. Adams (*Sec.*), W. A. Connolly.

Outdoor Track

Again School's track team has demonstrated its superiority by winning the Rowell memorial cup. This year U.C. provided keen competition during the first part of the meet, but fell down badly towards the end and the final result was Science leading with 52 points, followed by U.C. with 35, and Meds with 18.

Led by Ralph Adams, member of Canada's last Olympic team, who won both the 100 and 220-yard dashes, the track squad amassed 32 of the 52 points scored. Walter Connolly's success in the 220-yard low hurdles equalled in brilliance the performances of Adams. In this event Connolly was a full second below the mark set by Mackenzie of Science in 1926. Bev. Puddy was third in this event and showed fine form, considering his two-year lay-off. The most outstanding success of all came from the 440-yard dash, in which three of our men scored points. Mal Smith won the event, although he was hard pressed by Duff Thompson. Eaton, a freshman, placed third, and in so doing showed great promise for the future. School was unfortunate in not having many good middle-distance men as the results of the half-mile, mile and three-mile events proved, when not one Science representative placed. The remaining six points scored by the track squad came from the relay. The first team, composed of Smith, Howe, Thompson and Connolly, won the event, with the second school team third.

In the field events, Science men clearly outshone their opponents by winning four firsts out of a possible six. Ed. Peaker was the high point scorer, gaining a first in the javelin and also in the shot-put. Hal Collins won the running high jump, and Ed. Hymmen scored a first in the broad jump. Panay Ballachey contributed four points with a second in the discus and a third in the shot-put.

Charlie Morrison, congenial coach and manager, repeating his previous successes, had the boys in the best shape possible.

It is to be hoped that School will continue its victories in this line of sport, and with a little more support from the freshman year, this is assured.

SCHOOL GYMNASTIC TEAM

W. R. Sirman, R. M. Wilkinson, H. F. Bengry.

Gymnastics

The Harold A. Wilson trophy, emblematic of the Interfaculty gymnastic championship, will spend another year in the "Little Red Schoolhouse."

Wilkinson, Bengry and Sirman of the first team won the annual interfaculty meet while the second team, composed of MacKay, Sime and Weston made a most creditable showing.

As usual, School was well represented on the intercollegiate team this year, both Wilkinson and Bengry being regular members.

With so many Schoolmen taking an active interest in gymnastics, the prospects of retaining the interfaculty championship next year are very good.

R. M. Wilkinson,
Manager

Indoor Track

Following the success of the outdoor track season, the school athletes rested on their laurels, and the indoor season was for school an inauspicious one.

Ralph Adams demonstrated his superiority in the sprints, winning the 100 yards with apparent ease, and repeating with a victory in the 220 yards. The half-mile relay proved easy for the school sextet, who won by two seconds from U.C. R. Eaton. of school, who is a newcomer, performed well, and should be a certain point winner next year.

Altogether, a certain amount of indifference was displayed by many of the School athletes, and U.C. won the meet by a substantial margin. School need not be disheartened by this. We have the most powerful group of athletes on the campus, by far. The appointment of an energetic indoor track team manager should solve the difficulty, and next year the school athletes will no doubt occupy the stellar standing they deserve.

W. A. C.

SCHOOL B.W. & F. TEAM

Back Row: C. L. Wallbridge, D. Strachan, M. A. Elson.
Front Row: H. G. Field, F. A. Fell, C. E. Bannister, W. D. Brownlee, J. A. Taylor.
Absent: J. C. Eaton, S. A. McCatty.

B. W. & F. Club

The results of the School assault indicated a good year for the School B. W. & F. Club in subsequent competition, and so it turned out. In the junior interfaculty assault, School amassed more points than any other faculty, due largely to the splendid efforts of the same men who made such a good showing in the School assault. For the final test, the senior assault, the Old Guard came into action to aid in the cause, and when the battle was over it was found that the long reign of the Aggies in local mitt and mat circles had come to a close, and S.P.S. now wore the crown. The margin of victory was the slimmest possible—one point—but it was none the less sweet.

During January, the Varsity wrestling team took a trip to Annapolis to engage the Navy grapplers on the mat. Three Schoolmen were on this team,—Brownlee, Bannister, and Smith. According to reports, the boys had a good time—they saw the Capitol, and White House, and everything.

When the time came around for the intercollegiate assault, five schoolmen were fortunate enough to obtain coveted places on the team. Doug Smith had the misfortune to crack a rib in practice, which put him out for the rest of the season, and deprived him of a sure place on the team. Teddy Fell, as was expected, had little difficulty winning the featherweight boxing championship again. He put his men away in both bouts. The first one lasted only one round, but in the second bout the McGill man, profiting by the experience of the Queen's man on the previous night, kept on his bicycle and thus managed to stave off the inevitable until the third round.

Strachan, a light heavy-weight, stepped up a weight to fill the gap in the heavy-weight ranks, and put up a plucky fight although greatly outweighed by Wilson of McGill, the champ. Bill Brownlee, the flyweight wrestler, had tough luck in his bout with the last year's champ from McGill. Bill was ahead throughout most of the bout, but just before the end his opponent scored a fall, and thus got the decision. It was too bad, especially as Bill is in his last year.

Bannister, last year's winner at 123 pounds, retained his championship in the new 126-pound class. McGill offered stiff opposition in this weight, but Bannister proved beyond doubt that he was the better man.

Next year the club will carry on under the able guidance of Ev. Rudd, and we wish him lots of luck.

H. G. Field

The School Assault

The first sign of renewed activity in the cauliflower business by Schoolmen was evidenced on December 3, when the annual School Assault was held. This tournament, which is primarily for those who have not previously distinguished themselves in what we laughingly refer to as the manly art of boxing and wrestling, brought forth an unusually large number of leather pushers and tendon pullers, all with mayhem in their hearts. When the smoke cleared away only nine were left standing in the shambles. Bannister, who temporarily abandoned his occupation as chiropractor for the more genteel one (says we) of plastic surgeon, was highly successful in this new line of endeavour among the feather-weights. It is reported that several ringside spectators caught cold from the draft created by his herculean passes in the general direction of his opponents. Bill Marsh won the light-weight boxing title after a couple of good hard scraps. Bush rather upset the dope in the welter-weight class by getting the better of Hedley in a veritable slug-fest. In the middle-weight class, E. R. Eaton (no relation to Firpo Eaton), another hitherto unknown quantity, won handily. Mel Elson, fresh from the gridiron where he had to confine his slugging to moments when he thought the ref wasn't looking, was naturally right in his element in the ring and annexed the light heavy-weight title.

In the wrestling, Barber, after losing in the feather-weight boxing came back strongly to win his weight on the mat. In the light-weight class, Tommy Kirk surprised all his friends and incidentally himself, by winning. Jim Eaton, of that famous fighting family, proved himself the best man among the welter-weights (and what a crowd of them there were!) by a good display of combined strength and wrestling ability. The middle-weight wrestlers showed some of the old treat-'em-rough-and-make-'em-like-it stuff that the pros produce, and thereby greatly warmed the heart of Mr. W. H. (Whataman) Martin. Mason laid out Scythes with a body slam, but in the finals had his shoulder dislocated (or something) by Geo. Dimitrieff, the Ruthless Russian, who won the title in his class.

All the boxing and wrestling bouts were keenly contested (which sounds like the old line of hooey, but we really mean it) and the boys put on a damn good show. This talented array of assault and battery artists augured well for School's chances of success in the interfaculty assaults which were to follow.

H. G. Field

Senior School Rugby

Following the old Senior School custom, the senior team did most of their practicing during their games. To further cut down on overhead they dispensed with the services of a coach and all but the most necessary services of the manager. In spite of these serious handicaps the team put up a real battle for the group honours.

Ten of last year's team turned out to form a nucleus about, which the team was built. Of these, Zieman, Cowie, Fotheringham, Butterill, Anderson and Brenneman were line players, and Joyner, Ballachey and Baillie, backfielders. A number of fourth year men, who had been hiding their football ability for the last three seasons, turned out this year and, from the game they played, would have been useful in School's line-up every year.

The unanimous co-operation of the team and the leadership of Tommy Kirk, the captain and quarterback, were sufficient to overcome Dents, but, unfortunately, could not stop Meds. Although they did not secure a win from their ancient rivals, Meds, School played fast, hard-fought games and the play throughout was close.

Twenty of the twenty-three on the team will graduate this year, the gods willing, and the faculty permitting, but plenty of material will be available from the next third year.

Line-up—Kirk (captain), Zieman, Anderson, Fotheringham, Butterill, Brenneman, Cowie, Joyner, Ballachey, Baillie, Styles, Vigars, Dewar, Parks, Howe, A. Jansen, Switzer, Boone, McLean, McCartney, Montgomery, Alexander, V. Jansen, and

H. J. Slocombe,
Manager.

Junior School Rugby

There was every indication of a very successful season for the Junior School rugby team. There was no lack of good material from which to choose. Some 36 or 40 candidates turned out to the first few practices and lack of time necessitated a hurried weeding out.

The majority of last year's team was back and the odd one from the year before, but they all had to hustle to make their positions so very little was there to choose between the men.

The first game was on them before they realized things were getting serious. By hard fighting School defeated Junior Meds in the opener by a score of 16-0.

The next game with Pharmacy found School working together better but the game turned out to be a "comedy of errors," which resulted in another victory, 16-6, for School. The engineers were unfortunate in losing their quarterback, Watkins, who sustained a dislocated elbow, which put him out for the season.

Junior Meds showed quite an improvement in their second

encounter, which School took, however, by a 12-0 score. The final group game saw Pharmacy out to try and tie School for first place, and how they fought! School won, 15-1, but the game was a great deal closer than the score indicated.

For the semi-finals, Senior Meds were drawn to play Junior School at the stadium. They felt pretty confident of a win as they outweighed School by a good margin. By good fortune or otherwise, School came out on top of one of the hardest fought games of the season, 7-4.

The following week saw School up against St. Mike's for the Mulock Cup championship. Everyone felt sure it would be a walkaway for the Saints, who had brushed aside all opposition by unusually large margins. The game proved rather closer than expected when School held them to a 2-2 tie in ten minutes overtime. Although outplayed along the line, the superior kicking by School kept the score even.

School had more confidence in the next game. They played a kicking game right from the start and through good tackling and better kicking were leading 5-0 at half-time. Fate seemed to be against them for in the last half St. Mike's scored a single and two touchdowns, both on blocked kicks. School, however, showed the fans one of the most thrilling finishes of any game this year by their clever display of onside kicking coupled with several trick plays which more than had the Saints on the run. The final score was: St. Mike's, 11; School, 5.

H. K. C. McNichol,
Manager.

Senior School Hockey

Senior School did not get a chance to burn up the ice in the Arena this year, due to the fact that Dents won too many games. They nevertheless made a very creditable showing, in spite of the handicap of playing without a regular goalie. The first game went to Dents by one goal, and the second to Meds, but after that we won from U.C. twice and tied with Dents. This was not sufficient to win the group, however, and the latter team went on to be nosed out by Junior School's hefty puck-chasers. The team played good individual hockey all the way through and occasionally developed some real team play. Their strong point was aggressiveness when on the short end of the score, which showed up most strongly in the first game with Meds, when for the last five minutes of play, the only man inside the school blue line was the goalie. The team will be practically intact next year and our minds are firmly set on seeing the Jennings Cup with a familiar little inscription on its base.

J. A. Fisher,
Manager.

Junior School Hockey

JENNINGS CUP FINALISTS

This year School came closer to winning the interfaculty hockey championship than it has for many years past. After many hard-fought battles, U.C. was defeated, and Junior Meds were tied for the group championship. This called for an extra game, which had a favourable outcome from School's viewpoint.

With a bye to the semi-finals, the teeth-loosening Dents were next played and School came from behind to win the game, 3-1. This necessitated crossing shillelaghs with St. Michael's in what turned out to be a battle royal. St. Michael's emerged victors but not until it had been forcibly impressed on them that School was not going to be defeated in an easy manner.

It is hardly fair to pick out any particular players on the team as they were all of the first calibre, but the work of Keith Little with "Al" Williamson on the defence, and of "Harp" McNichol and "Vic" MacLachlan on the forward line, was especially outstanding.

The team and manager wish to thank Fred Murray, who, when the Senior Varsity hockey schedule was over, ably gave much assistance to the coaching of the School team.

The manager would like to suggest to all prospective managers in School that, although at times the work may seem fruitless, one derives a wonderful satisfaction from knowing that a team of your fellow-students is out on the ice or field doing its very best for School, win, lose or draw. For this one reason alone, he advises all those who are interested in managing, to make every effort to get the position.

C. G. GIBSON,
Manager

School Rowing

School has always been a leader in this aquatic sport, for which a strong back and a weak mind are the only requisites. However, it is hardly being fair to our oarsmen to say no more than that. It is the old fighting School spirit which has been largely responsible for our past success, and which will continue to cause the School boat to lead the way across the finish line in future regattas.

This year was indeed a very exceptional one in School rowing history. For the first time since the inception of the annual inter-faculty regatta in 1923, the winning crew did not carry the School colours!

Is it possible that the calibre of our crews is declining? Are our backs becoming weaker or our minds too strong? Not likely! The truth is that the other faculties and colleges are turning out better rowing material than heretofore, due partly to the increased interest in the activities of the University Rowing Club through the spring and summer. This is a good sign and we say "more power to

them." It was not a healthy condition to have the same faculty always the winner. However, School never renounced its hold on anything voluntarily and we may expect some really good regattas in the immediate future.

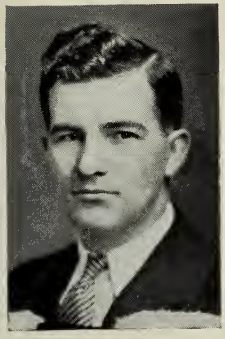
Much credit is due to the men who turned out early last October on the machines in Hart House, and later down on the water night and morning in spite of the spell of cold weather which came just at the worst time. Two crews were finally picked from the many aspirants and these did their best to get into shape in the few remaining days.

"Squeak" Chalmers, that veteran coxswain, who has been the brains of many winning crews in recent years,—including the last two intercollegiate crews—and who is recognized by all as School's greatest single rowing asset, occupied the stern sheets of the senior boat, which was stroked by "Shorty" Crooks; W. E. Algie, L. K. Lytle, H. Popplewell, G. F. Hayhurst, D. S. M. Kerr, W. H. Gilleland and B. B. Puddy pulled the remaining oars. This crew eliminated Dents in a preliminary heat and in their next race came up against U.C. Well, the less said about this race the better; however, it is only fair to say that it was an extremely close, and hence exciting, race. As the two crews neared the finish line at the boathouse, they were stroking alternately and hence were see-sawing for first place. So close was the finish that no one but the finish judge knew which boat had won. U.C. then had no difficulty taking the final race from Victoria.

School's second crew was no slouch either, only it had the—misfortune shall we say?—of coming up against U.C. in its first heat. This crew consisted largely of the freshman crew which got into the finals the previous year. These men showed much enthusiasm and will undoubtedly take a leading part in their remaining two years.

Schoolmen have always been prominent in Varsity rowing, and in the coming Olympic trials they can be counted on to do their utmost to give Old Varsity the honour that was hers in the 1924 Olympics when Varsity's eight was second only to Yale.

J. M. Boyd,
Manager



The Bronze "S"

This award has been granted this year to Bert Tyson, probably the outstanding man in many years for his ardent School spirit. In his first year he developed a desire to see School leading the parade in athletics and set out earnestly to further it. Conscientious plugging at B. W. & F. activities placed him on the Intercollegiate Assault Squad in 1929 as a wrestler, and in 1930 as a boxer. In both departments he showed great ability, winning his "T" in the 1929 wrestling.

Not content with this, Bert decided to play rugby and gained a regular middle wing berth with Junior School in 1928, and Senior School in 1929. In the fall of 1930 he turned out to practice with the Orphans. Unfortunately he received an injury in one of the practices, which combined with his heavy executive activities, kept him out of sports for the remainder of the year. His interest, however, has never died, and he is still first, last, and always, an Engineer of S.P.S.

Junior School Basketball

School's Junior basketball team did not go very far in this year's interfaculty race, but it was well worth the effort as it uncovered a host of exceedingly good freshman material. The whole source of failure was due to the fact that practically all the players were strangers to each other's style of play.

Seven freshmen and three sophomores made up the team and my figuring is that if the seven freshmen stay together and start in next year where they left off this year, Junior School will have a team hard to beat. Lichty, Tenembaum and Wong, the three sophomore members of the team, having played together the previous year, understood each other's style and added great strength to School's attacks. These three men should provide an exceptionally good nucleus around which to build a strong Senior School team next year. Cahoon, Hall, Waldron, Wilkinson, Hagerman, Cooperman and Wood were the freshmen members and in this lot

there is a wealth of basketball material. If one could rely on these seven freshmen along with a few good men coming into School next year, the outlook for basketball would be indeed very bright.

The old fighting spirit of School was very noticeable in each and every member of this team and one knows that that alone goes a long way toward making a winning organization.

May the undersigned take this opportunity of thanking all the members of the team for their whole-hearted co-operation and the splendid and enthusiastic way each man regularly turned out for practice. It was indeed a pleasure to manage such a group. May lots of luck be in store for the Junior School basketball team next year.

DUNCAN G. GRANT,
Manager

Senior School Water Polo.

The Senior School team hit the long road this year with a meagre turnout in point of numbers, but enthusiasm, in spite of the fact that no one gave the subject of practice the least consideration, galloped hand in hand with an astonishing facility on the part of the front line of finding the "far top corner," with the result that the first few scalps were separated from their lawful owners by a woefully transparent margin. As the season progressed, the job of putting a full team in the pool became less and less like trying to appoint a committee of one to call off a lab. There was actually a practice held after we had won our group and were considering entering the semi-finals. It was then that the players began turning out by the hundreds and the main worry of the regulars was in keeping the newcomers from nabbing all the glory.

Now all too little remains to be told. Johnny Powell wasn't carrying his perennial rabbit's foot when we tossed for the bye. So we waded into the creek one Monday evening all set to run up an appalling score. Lady Luck wasn't in, or, rather, the Junior Meds sharpshooters *were*, and when the gong gonged, the denizens of dissection had the lion's share of a 3-2 score. The bottom of the pool looked like the top floor of the Anatomy Building after a gang-war.

Credit is due to "Capt. Hank" for his leadership, in spite of us not bringing home the laurel wreath, and our hope is for better success next year.

J. A. FISHER,
Manager

Junior School Water Polo

With the entry of two more teams in interfaculty water polo this year, a division into three groups had to be made and Junior School drew a place in the group where opposition was much the keenest. This, however, proved a blessing, as the team, mostly composed of freshmen, learned more about water polo by playing against the most capable teams.

Few of last year's championship aggregation, who brought the trophy to School, were left, but the freshmen turned out in enthusiastic numbers to learn the game. The team was greatly handicapped after the first game through the sickness of the captain and very capable forward, Jim Craig.

After strenuous practising, Junior School played the games in the series, every one of which was a real struggle, and in the end bowed to the champions of the group, Junior Meds. This team, incidentally, captured the cup this year from School.

The Junior School team was made up of the following:—Jones, Towers, Wood, Walker, Swallow, Hawke, Adams, Fraser, Hinnegan, Penney and Bengry.

Junior School, if as enthusiastic and as capable as last year, should prove a real threat. It's up to them to bring back the trophy to School next year.

E. O. Withrow,
Manager

Senior School Basketball

The strength of the senior basketball squad was seriously impaired when Al. Pasternack, star centre man, and Hutchison, an equally luminous forward, left to play for the University team.

Although the practices were not very enthusiastically attended, a surprisingly strong team was organized with Mercer, Kirk, and Britnell working well together on the forward line and the big defence of White, Ballachey, Ireland, and Smith effectively barring the way to the basket.

The first game was disappointing in that we were beaten by our none too good friends (athletically), Victoria.

Our appetites for victory were, however, whetted when we easily defeated Dents and when the return game with Vic was played we upset their calculations by defeating them quite handily.

This necessitated a play-off game and what a battle that was!

When the smoke had cleared away we found ourselves on the short end of a 15-14 score.

Wishing Vic the best of luck and sending them on their way with a defiant Toike-Oike, we collected our basketball togs to give to the kid brother, for most of us will have no more use for them.

A. L. Wilson,
Manager


Capt. W. S. Wilson
Adjutant U. of T. C.O.T.C.
Major J. Roy Cockburn M.C.
Second in Command U. of T., C.O.T.C.
Lt.-Col. T. R. Loudon
O.C., U. of T., C.O.T.C.
Capt. W. J. T. Wright M.B.E.
O.C., 'C' Coy.
Capt. A. R. Williams
Second in Command 'C' Coy.
H.Q. OF THE U. OF T. CONTINGENT
C.O.T.C.
AND THE
OFFICERS OF 'C' COY.
1930 1931
Lt. G. W. Jacobi
Lt. H. I. Watts
2nd Lt. W. L. Durton
2nd Lt. A. G. Brannegan

Junior School Baseball

The Spalding Cup, emblematic of the interfaculty indoor baseball championship, failed to return to School this year. After winning their group with comparative ease, they were drawn to play with O.A.C. and Victoria in a three-team series. After defeating O.A.C. easily, a game was played with Victoria. With school leading 8-6 and with but one inning to play, the game was called by Mr. McCutcheon on account of the time limit, necessitating a re-play of this game. The return game with O.A.C. was played in Guelph, and due to home-town umpiring, the team was forced to concede this game by a one-run margin. But due to greater superiority in the first game, School took the round.

The next game was lost to Victoria by a 3-run margin and this forced them out of the runn ng.

The battery was Shapiro pitching and Chalmers again catching. The infield positions were held down by Hewett, J. A. Howe, P. S. Howe, Carbone and Mason. The outfield consisted of Jones and Black. Hal Collins was not always available due to illness.

The main strength of the team was its great hitting power, scoring 59 runs in six games. There was also a great display of fielding at times. Most of this team will be found playing for Senior School next season, and a successful year is expected.

T. J. CARBONE, *Manager*

School Soccer

Although School ranked low in the soccer play-offs this fall, yet we may be considered to have had one of the most successful seasons of recent years. This may, perhaps, sound Irish, but it is nevertheless true that more contestants for the eleven positions turned out this year than for several years past.

Upwards of twenty-five men practised consistently and hard, and it is to be regretted that teams could not be arranged to include more of the active members of the club as the calibre of play and condition shown by those who didn't "make" the team was of a very high standard.

We hope that this will be altered next year when it is assured that we will be able to field two teams in the interfaculty series. This will give everybody a chance to represent School in at least one game of the series and should be the start of building up a very strong team in this interesting sport.

The loss of Matt Ward will be seriously felt as his neat footwork and clean play were always much appreciated in the pinches.

Gordon Gregg is to be congratulated on his election to the vice-presidency of the University Soccer Club for the coming season. With such men as we leave to carry on, those graduating feel no hesitancy in handing them the torch, knowing full well that the game will be played well and the players will be game to the end.

J. N. FRANKLIN, *Manager*

Senior School Baseball

The ball season rushed down upon us before we realized that we should be up and doing things. As a consequence, Dents whitewashed us in the first game by a score of 12 to 0.

However, we soon hit our stride, and thanks to Earle Daveys' pitching, took our next games in the approved fashion. Our second meeting with Dents came our way and this tied us with them for group honours. In the play-off the School men played real ball to win, 13 to 1.

As group winners, we were teamed with U.C. and O.C.E. for the play-off. The "Teachers" were easy, but U.C. proved the stumbling block. In our first game, they beat us 12 to 0. The game, however, was far from being as one-sided as the score would indicate. The second game was hard fought. Earle Daveys pitched wonderful ball to strike out 13 men, and it was through no fault of his that we came out on the lean end of a 3 to 1 score.

Ralph Adams teamed up with Earl, while Karl Moeser, Bill Campbell and Bill Edmonds held down the bags. Bill Carmichael and Brad Proudfoot specialized in the long ones off the back wall, and "Jock" Wilson and "Ab" Jansen covered in close at short. Altogether, Senior School had a smart ball team, and it was a keen disappointment to miss the Spalding Cup.

E. S. Jewett,
Manager.

The Rifle Association

"Oh, hell! What have we here?" A university organization whose membership is approximately forty per cent. Schoolmen. For the good of the Association, perhaps this is as it should be.

Before going into detail as to said Schoolmen's activities, for the benefit of the uninitiated, it might be well to give a brief résumé of the University of Toronto Rifle Association's field of activities.

The season opens in the fall with practice at the Long Branch rifle ranges at 200, 500, and 600 yards. The intercollegiate service rifle championship is decided at the above ranges in a match held about the end of October. Everybody shoots in this match and the eight high men constitute the intercollegiate team. The five high men from each faculty form the various interfaculty teams, competing for the Delury shield. A copious supply of gold, silver and bronze medals are given away, as well as a cash prize list totalling over fifty dollars.

The scene then shifts to the Association's ranges in Hart House, where practice is carried on with .22 and .303 rifles until Christmas. After the effects of the Christmas dinners and New Year's carousals have worn off, the winter's shooting starts in earnest. Two matches are shot under D.C.R.A. auspices. The D.C.R.A. gallery practice match is shot in three strings, one each month, using the S.M.L.E. rifle with reduced loads. The inter-university indoor match is shot in the same way on approximately the same targets, using .22 rifles. Each month a spoon shoot is held, competitors being divided into groups according to proficiency, so that they are always shooting in their own class. In March, the interfaculty indoor match is shot with the Mitchell Cup at stake.

The season ends in March, when the annual banquet is held and prizes are distributed. This is an unique event in that nobody gets drunk.

In past years, Schoolmen have added much to their collection of hotel and restaurant equipment from the Rifle Association prize list. Of the eight spoons shot for in January and February of this year, three have come to School. Also, S.P.S. has been well represented on the intercollegiate teams as is to be expected. However, here we come to a tale of woe.

In the interfaculty outdoor championship match last fall, S.P.S. allowed the Meds to take the Delury shield, which school had held for two years, by the narrow margin of three points. To make matters worse, the Mitchell cup, which had also spent two years in the Engineering Society, went the same way, this time by one point.

It was our intention to put this under the obituary column, but on second thought decided that it was another case of "She is not dead, but sleepeth." With this year's team intact, and any pos-

sible additions from the incoming first year, the chances for next year acquire a tint best described as rosy. As for this year's work, this is neither the time nor place for alibis, and the boys have none to offer. The Varsity might sum it up by their well-worn phrase, "The score was no indication of the play," but far be it from us to even suggest such a thing. In the meantime, a meeting has been called at which the members of the team will decide on the best date to tap each other.

For the benefit of the incoming first year, and others who have not taken advantage of their opportunities, we might say that the University of Toronto Rifle Association offers the use of one of the finest ranges in Toronto, and rifles and ammunition are provided free. Expert coaching and instruction is available and the prize lists leave nothing to be desired. Shooting is done at convenient hours three afternoons a week, and there is always room for one more.

This year's shooting is over. Next year's will commence in due course. When it does, "Let's go." If you can shoot we need you; if you can't, we will teach you.

A. C. MacNab,
Treasurer, U.T.R.A.

S.P.S. ATHLETIC ASSOCIATION

FINANCIAL STATEMENT, 1930-31

ASSETS

Balance 1929-30	$ 85.98
Interest	1.27
Fees	1,696.00
Fees-late registration	3.00
Petty Cash	8.15
	$1,794.40

EXPENDITURES

B.W.&F.	$ 44.55
Tennis	2.00
Soccer	57.20
Rugby	358.58
Baseball	95.85
Basketball	97.96
Swimming & Water Polo	37.02
Track	50.05
Rowing	20.00
Gym	13.08
Torontonensis	130.00
Transactions	50.00

Miscellaneous

Athletic Association	131.86
Petty Cash Disbursements	3.50
Medical Account	190.00
Audit 1930-31	10.00
Photography	28.53

Cash on Hand

Bank	467.01
Petty Cash	7.21
	$1,794.40

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

OPERATING STATEMENT

APRIL 1, 1930 TO MARCH 31, 1931

SUPPLY DEPARTMENT

Sales		$15,227.99
Deduct—Cost of goods sold:		
Inventory, April 1, 1930	$ 2,500.00	
Purchases	11,549.14	
	$14,049.14	
Less Inventory March 31, 1931	2,600.00	
Cost of Goods Sold		11,449.14
Gross Trading Profit		$ 3,778.85

GENERAL OPERATING STATEMENT

Gross Trading Margin—Supply Department		$ 3,778.85
Deduct—Salaries		1,044.00
Operating Profit after salaries		$ 2,734.85
Add—Fees	$1,699.00	
Grant—Board of Governors	150.00	
Interest received	296.55	
School Night—Surplus	36.26	2,181.81
Available for Expenses, etc		$4,916.66
Deduct:		
General Expenses	$ 570.69	
Grants to affiliated clubs	107.50	
Donations, etc	274.60	
Dinner—Deficit	290.31	
Election Expenses	178.87	
School At-Home	251.48	
Photographs	430.50	
Publications	409.71	
Printing and Stationery	24.70	
Depreciation—Office Equipment	80.00	2,618.36
Excess of Revenue over Expenditure—to Surplus		$2,298.30

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

BALANCE SHEET

MARCH 31, 1931

ASSETS

CURRENT			
Cash		$ 201.80	
Bank—Current		102.30	
Bank—Savings		3,140.06	
Accounts Receivable	$ 795.70		
Grant due from Board of Governors	150.00		
Employment	50.00		
Suspense—Returned Cheques	62.35		
	$1,058.05		
Less Reserve for Bad Debts	326.12		
		731.93	
Inventory—Supply Department		2,600.00	
			$ 6,776.09
INVESTMENTS			
Bonds as per list in written report (Par $5,500)			5,540.00
DEFERRED CHARGES			
Insurance unexpired			52.80
FIXED			
Office Equipment	$ 852.34		
Less Reserve for Depreciation	545.00		
		$ 307.34	
Smoking Room Furniture	70.00		
Less Reserve	60.00	10.00	317.34
			$12,686.23

LIABILITIES AND SUPPLIES

CURRENT LIABILITIES			
Accounts Payable			$ 656.88
SURPLUS			
Balance April 1, 1930		$9,731.05	
Surplus for year		2,298.30	
			12,029.35
			$12,686.23

University of Toronto

The Provincial University of Ontario

The University of Toronto has the following Faculties: Arts (including Sciences and Commerce), Medicine, Applied Science and Engineering, Household Science, Education (Ontario College of Education), Forestry, Music, School of Graduate Studies, Dentistry.

Arts Colleges: University College, Victoria College, Trinity College, St. Michael's College.

The School of Hygiene, housed in the building provided by the International Health Board of the Rockefeller Foundation, embraces the Department of Hygiene and Preventive Medicine, the Department of Public Health Nursing, and the Departments of Biometrics and Epidemiology and Physiological Hygiene. The Connaught Laboratories, which consist of Research, Antitoxin, and Insulin divisions, are intimately related and in close affiliation with the School of Hygiene. Teaching, research, and public service are the functions of this School and of the Connaught Laboratories.

Special Departments: Social Service, University Extension.

Federated Theological Colleges: Knox College, Wycliffe College and Emmanuel College.

Affiliated Colleges: Ontario Agricultural College, Ontario Veterinary College, Ontario College of Pharmacy, Ontario College of Art.

Other institutions controlled by the University: Royal Ontario Museum (in conjunction with the Provincial Government), Toronto Conservatory of Music.

The University has very close affiliation with the Toronto General Hospital and privileges in the Sick Children's Hospital, St. Michael's Hospital, Western Hospital, and the Psychiatric Hospital.

Hart House is a unique recreational, social and athletic centre for male students. There are residences for men and women students, and a Students' Union for women.

The average annual enrolment, apart from that in affiliated colleges and in extension courses, is approximately 7,400.

Address:

UNIVERSITY OF TORONTO, TORONTO 5, ONTARIO